THE RAILWAY GAZETTE
A Journal of Management, Engineering and Operation
INCORPORATING
The Railway Engineer · TRANSPORT · The Railway News
The Railway Times · Herapath's Railway Journal ESTABLISHED 1835 · THE RAILWAY RECORD.
RAILWAYS ILLUSTRATED · THE RAILWAY OFFICIAL GAZETTE

PUBLISHED EVERY FRIDAY
AT
33, TOTHILL STREET, WESTMINSTER, LONDON, S.W.1
Telegraphic Address: "TRAZETTE, PARL, LONDON"
Telephone No.: WHITEHALL 9233 (6 lines)

Annual subscription payable in advance and postage free
British Isles and Abroad.....£2 5s. 0d.
Single Copies.....One Shilling
Registered at the General Post Office, London, as a Newspaper

VOL. 68. No. 17 FRIDAY, APRIL 29, 1938

CONTENTS

	PAGE
Editorials	821
Letters to the Editor	826
Publications Received	827
The Scrap Heap	828
Overseas Railway Affairs	829
The Railway Position in Argentina	831
Ferries and Bridges in Denmark	832
Colour-Light Signalling on the Chingford Branch, L.N.E.R.	835
Replacing Wooden by Steel Coach Bodies in France	839
Thirty Years of Rack Working on the Benguela Railway	841
Railway News Section	843

ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue

The Budget and Transport—Lowbrow

THE ordinary man's first thought when he learned the details of the Budget announced in the House of Commons on Tuesday night by Sir John Simon was that it will have the effect of reducing his spendable income both directly through the increase in the rate of income tax and also indirectly by the repercussion on the individual of increased indirect taxation. His natural reaction is to consider in what way his spending may be reduced correspondingly, and naturally luxuries are the first things to suffer under the operations of his domestic "economy axe." Non-essential transport and holidays, of course, come within this category, and to that extent railways, and indeed transport in general, must suffer. Road transport is also affected by the increase of one penny in the duty on petrol and heavy oils. To some extent, however, this may be offset by the recent increases in the numbers of persons having holidays with pay. The financial requirements of rearmament were the dominant note of Sir John Simon's first Budget, and we expect that criticism will be directed mainly against its detail features rather than against its total demands. In connection with the increase of income tax from 5s. to 5s. 6d. in the £, it is interesting to recall that as recently as April 19 Viscount Horne, a former Chancellor of the Exchequer, pointed out in the *Daily Mail* that the income-taxpayer was then paying 5s. in the £, and in the height of war income tax never rose above 6s. He felt that it would be a very false policy to leave no margin between a peace-time impost and a war-time exaction. True, the new Budget leaves a margin, though but a small one.

* * * *

The Budget—Highbrow

With the incomes of large numbers of persons directly reduced by 6d. in the £1, and of nearly everyone indirectly by the rise in prices resulting from the increased taxes on tea, petrol, and oil, demand will inevitably fall. Such an artificial reduction in demand is not necessitated by any simultaneous contraction in ability to supply. On the contrary, productive capacity steadily rises. It is limited mainly by the failure of demand to supply adequate markets. Consider, for example, the transport services which actually compete for patronage and whose facilities, in the last few years, have actually shrunk because the public could not afford to use them all. They will be doubly hit by the Budget, first by the impoverishment of their customers, and secondly by rising prices. There is the possibility, of course, that, by the so-called law of supply and demand, prices may be forced down to what the public can afford to pay; but that, again, represents only a twist in the vicious spiral and leads to lower profits or even losses on the part of the vendors of goods and services. But, to avoid the endless path of technical discussion, the inescapable truth is that increased taxation means, first, a reduction of the individual's spending power, and secondly, and as a necessary result, a contraction of markets. *Facts* do not justify this. Do we then require punishment?

* * * *

The Week's Traffics

Latest returns of the four main line companies cover the week including Easter Monday, 1938, and compare with those for an ordinary week in 1937, so that, as shown in the accompanying table, passenger receipts are strongly up, but general merchandise and coal traffics are heavily down. Comparing the complete Easter holiday periods for the two years it will be found that passenger train earnings of the four companies for the 1938 fortnight totalled £3,166,000, an increase of £247,000 on 1937. General merchandise receipts for the 1938 holiday fortnight were £1,805,000, a decrease of £191,500, and coal traffics totalled £1,017,000, a decrease of £161,500.

	16th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 46,000	— 121,000	— 87,000	—162,000	+ 7 000	+ 0·07
L.N.E.R. ..	+ 29,000	— 90,000	— 58,000	— 119,000	+ 107,000	+ 0·77
G.W.R. ..	+ 40,000	— 69,000	— 44,000	— 73,000	+ 104,000	+ 1·35
S.R. ..	+ 37,000	— 12,500	— 8,500	+ 16,000	+ 131,000	+ 2·26

For Irish railways the latest returns had the benefit of the holiday traffics from Easter Eve to Easter Monday inclusive in comparison with an ordinary week of 1937, and showed net increases of £7,886 on the Great Southern, of £2,400 on the Great Northern, and of £1,818 on the Belfast & County Down.

* * * *

Robert Williams

Among the multifarious activities of Sir Robert Williams on the African Continent, railway construction occupied an important place although his primary interests were those of mining and he himself preferred the description

of a mining engineer. At the same time his enterprises were so closely interdependent that it is impossible to fix rigid boundaries between his developmental, mining, and transport activities. Robert Williams emigrated from Aberdeen to South Africa in 1881 when only 21 years old and soon formed a lifelong friendship with Cecil Rhodes. It was Williams who conducted the exploration work in Rhodesia and elsewhere in South Central Africa which provided the commercial justification for railway development northwards on the lines of the Rhodes Cape-to-Cairo plan, and perhaps Sir Robert's greatest achievement was his constant recognition of the facts that colonisation requires transport, and that the heavy costs of railway construction by private interests are justified only by commercial inducement. Sir Robert's activities were not confined to British possessions, for he inspired the railway link between Bulawayo and the Mozambique port of Beira, and also achieved the completion of the Benguela Railway and other lines forming the link between the Angola coast and South Africa *via* the Belgian Congo and Rhodesia. A brief account of Sir Robert's career appears on page 843, and some details of Benguela Railway working are included in a short article on pages 841-2.

* * * *

The Road Haulage Wages Bill

The long-awaited Government Bill to regulate wages in the mechanical road haulage business was introduced into the House of Commons on April 13. In the main the Bill follows the recommendations of the Baillie Committee, published in April, 1937. In seeking to tackle the present unsatisfactory road haulage labour position it is complementary to previous enactments whereby Parliament has already dealt with hours of work. The scope of the new Bill includes not only conditions of service, but also matters related to road safety and to the health of workers. Staff employed by the railway companies, is excluded, as was to be expected, seeing that their remuneration is already governed by existing machinery. Probably the feature of the Bill which will result in the greatest criticism is the size of the proposed Central Wages Board. This board is to comprise 12 members nominated by the Minister; 24 drawn equally from each side of the area boards; and three or five independent members. The board will thus total approximately 40, and is likely to prove unduly large. The Railway National Wages Board originally consisted of 17, but difficulties were encountered in the working of so large a body, and we feel that the experience of the railways should not be set aside lightly.

* * * *

Underground Railway Timetable Complexities

Some of the difficulties which London Transport has to overcome in compiling the timetables of underground trains were illustrated by Mr. Evan Evans, the L.P.T.B. Railway Operating Manager, in a recent lecture entitled "Some Phases of Operation on the Underground Railways of London" read before the Railway Students' Association. As an example of how through running could determine the scheduled speed over a certain section of line, he mentioned the Northern Line, where the services from Highgate and Edgware are divided, one portion of each service going *via* Charing Cross to Kennington and Morden and the other to Kennington and Morden over the 1¾-mile longer route *via* the Bank. From Kennington, the whole of the City Line and part of the West End service goes through to Morden over the same tracks. As the basic train interval from Camden Town to Morden is 1½ min. the difference in running time over the two routes between Camden Town and Kennington must be a multiple of 1½ min. Therefore there was a 15-min. journey over the shorter and a 19½-min. journey over the longer route and any variation made when the full service was being worked had to be equal on each route. The projection of the Highgate branch trains to Edgware *via* Finchley, Mr. Evans continued, where they would interwork with the Northern City Line service from Finsbury Park, would add further to the already complex work of timetable compilation over this section of the board's system.

* * * *

Continental Traffic Prospects on the Southern

Traffic returns of the Southern Railway for Good Friday week give good indication of the prospects of Continental travel for the 1938 season. Particulars given on page 785 of our issue last week showed that the Southern Company's passenger receipts were increased by £39,000. This increase was largely due to the heavy bookings to the Continent by the short sea routes, and figures supplementary to those already published have now come to hand showing that the number of passengers booked by Southern routes to French ports increased by 20·9 per cent., compared with the corresponding period in 1937. Traffic to Ostend, for Belgium, Germany, and other Continental destinations shows an increase of 14·5 per cent. In consequence of the drop in the French rate of exchange, passenger fares and baggage rates to and *via* France by the Southern Railway routes will, in the main, be considerably reduced on and from Sunday next, May 1. This reduction, coupled with the fact that travellers to France will be able to obtain more francs to the £1 sterling than they were able to last summer, suggests that the Southern Railway Continental organisation will again be highly tested to handle what may be a record volume of traffic.

* * * *

Leeds City Station

The combination of the Leeds Wellington and New stations on May 2 (briefly announced in our issue of April 15) will result in the formation of one of the largest provincial stations in Great Britain, for as Leeds City it will have sixteen platforms and cover 19½ acres. Much of the combined station will be entirely new, the booking hall and offices, waiting rooms, and enquiry office all having formed part of the extensive reconstruction scheme including the rebuilding of Queen's Hotel and construction of new offices for the L.N.E.R. and L.M.S.R. Companies. Wellington station was originally the terminus of the North Midland Railway, a line constructed to connect Derby, Rotherham, and Leeds, which reached Leeds on July 1, 1840. For six years the terminus was at Hunslet Lane, but the line was extended to Wellington station on July 1, 1846. New station, formerly the joint property of the North Eastern and the London & North Western Railway Companies, was opened on April 1, 1869, as part of the Leeds extension line built to connect the Leeds & Selby Railway (which had terminated at Marsh Lane) with the Leeds Northern line at Wellington Street. The combination of the Wellington and New stations in no way affects the name or business of the Leeds Central joint station.

* * * *

Transport Developments in 1937

The annual review of transport developments presented by Mr. R. Bell, Assistant General Manager, L.N.E.R., to the Institute of Transport on Tuesday, which we summarise on page 848, was announced as the last he would give. The Chairman, Sir Cyril Hurcomb, voiced the feelings of the meeting in expressing appreciation of the useful work Mr. Bell has performed in thus placing before members a continuous record of transport development

during the last 10 years. It will be a lamentable coincidence, however, if Mr. Bell's last report turns out to have coincided with a peak in railway net revenue like that of 1929. Mr. Bell reminded his audience that after many vicissitudes the British main-line railways did fairly well in 1929, only to see their earnings fall off again until the lowest depth was reached in 1932. It is significant that this catastrophic decline was heralded by the drastic Budget of 1931, and it is to be hoped that the severity of this year's Budget will not prove a similar augury.

* * * *

Effective Propaganda

A striking example of effective present-day railway propaganda was given by the L.N.E.R. on Tuesday last, in connection with a trip of the Crusaders' Union from King's Cross to Cranwell Air Station of the R.A.F., to witness a flying demonstration. After the party, consisting of boys from public and private schools, had seen an impressive air display, including a Hurricane flying at 350 m.p.h., it was announced by loudspeaker that at 5.30 p.m. their homeward-bound special train would be slowed down in order that they might also see the fastest train in the Empire—the Coronation—travelling at full speed. The point that had been arranged was on Barkston curve, where the Crusader special came into the main line from Sleaford, and so exact was the timing that it was not even brought to a stand, but was well on the curve, travelling at 10 m.p.h., when the down Coronation swept by at 90 m.p.h., in full view, at 5.30 p.m. on the stroke. Not content with this, the L.N.E.R. then provided the streamlined locomotive *Sir Nigel Gresley* to haul the boys from Grantham to King's Cross, whence this 500-ton load was worked to London at the speed of the Flying Scotsman, and actually attained a maximum speed of 90 m.p.h. at Essendine. On this occasion, therefore, the L.N.E.R. very effectively had the "last word."

* * * *

Clapton to Chingford Signalling, L.N.E.R.

Another stage in the replacement of the old style signalling on the L.N.E.R. suburban lines by multiple aspect signals was completed on January 30, when the six-mile Clapton—Chingford line was converted. The work is described on page 835. It is of interest that no four-aspect signals were required, the nature of the traffic and signal spacing making it possible to do with three-aspect signals throughout. A junction indicator at Hall Farm junction, similar to those in use for sometime on the Southern, is the first, we understand, in this area of the L.N.E.R. No power frames are included, the existing mechanical ones being fitted with electric locks and circuit controllers. An important feature is the system of control adopted for the gates at some busy level crossings, of which there are several in the outer suburban area of the former Great Eastern Railway. The new signalling with adjacent sections similarly equipped, will familiarise drivers with modern equipment in preparation for its extension as electrification proceeds. For 40 years this and neighbouring lines have been operated successfully with Sykes block, of the peculiarly complete form developed for the Great Eastern which, with the special bell code used, could be very rapidly worked.

* * * *

A Misinterpreted Hand Signal

The cause of the accident near Crewe, L.M.S.R., on November 16, 1937, is explained by Major G. R. S. Wilson's report summarised on page 853. A dense fog prevailed, and the Coppenhall Junction signalman did his best to carry out Rule 39(*a*) by observing his track indicators. He lowered his outer home for the Perth train, but it over-ran the inner home without the driver seeing it, and—there seems no doubt—exploded the detonator the signalman had prudently placed on the rail outside his box when he received "train entering section." He gave the signal to stop by raising his arms at an open window, but the driver, who—with his fireman—declared he heard no explosion there, mistook this for an arm being waved as a signal to proceed. "Train running away" was forwarded a little late, and the Glasgow train was only just moving at Crewe Coal Yard home when the collision occurred. How both men should have failed to hear the detonator is not easy to explain. Major Wilson, emphasising the admitted value of detonator placers worked from boxes, recommends that the existing one-shot type be replaced by the two-shot pattern, now the L.M.S.R. standard for new work.

* * * *

A German Locomotive-Builder's Anniversary

Maschinenfabrik Esslingen, which supplied the rack and built the rack locomotives for the Benguela Railway described on pages 841-2, last year celebrated the 90th anniversary of its foundation. In 1847 it built its first locomotive, a 2-4-0 mixed traffic locomotive for the Royal Württemberg State Railway, now absorbed into the German State Railway system. In respect of rack locomotives Maschinenfabrik Esslingen was a pioneer. In 1876 the firm built the first rack locomotive in Europe, a short-lived experimental Wetli type. The first exclusively rack locomotive built in Germany followed in 1883 and did good service for over 40 years on the Drachenfels Railway (1 in 5 gradient) until it was superseded in 1926 by a new Esslingen superheated-steam locomotive. The same firm built for the Harz Railway in 1885 an 0-6-2 Abt combined adhesion and rack locomotive, which at the time attracted considerable interest as the first rack locomotive in the world designed for main line service. Since then Maschinenfabrik Esslingen has built more than 265 rack locomotives and more than 94 miles (150 km.) of Riggenbach rack.

* * * *

H(2) "Eau"?

Legion must have been the occasions on which, in a place provided for the washing of hands, we have been led astray by erroneous labelling to the extent of discovering (usually on a bitter winter's day) that H. and C. to the eye was C. and C^2 to the touch. We imagine, however, that to come across the converse (*i.e.*, two taps vying with each other in regard to output of H.) is rare enough to warrant the overdone heading of "Record." Such, nevertheless, was our experience when travelling recently on a certain main-line train "Somewhere in England." Turning on the C. tap we were amazed to feel the water in the basin grow hotter; still incredulous, we placed one finger under the outflow, and in one split second we knew that someone had blundered. Had it been raining, we could have solved the problem by opening the window and holding our caked extremities under a refreshing draught, but alas! the sun shone remorselessly, and after resorting to the barbarous but unavoidable expedient of hiding our soapiness in a welcome towel, we retired to our compartment full of strange thoughts. While the railway in question (having already been in more than a modicum of "hot water," we shall not divulge its identity) may regard such a gesture as a token of "e-steam" for its grimy and weary travellers, we shall deem it a favour if in future such warmth of lavatorial welcome be tempered with the coolness that refreshes and does not repel.

San Paulo (Brazilian) Railway Co. Ltd.

ON the main line of 86½ miles on the 5 ft. 3 in. gauge from the port of Santos inland to Jundiahy the traffic receipts showed in the year 1937 an increase in currency of 6,148 contos, or 4·79 per cent., and in sterling of £141,150. Net revenue of this section was £525,720 in 1937, a decrease of £9,726 in comparison with 1936. On the Bragantina section of 67 miles (metre gauge) there was a loss on working of £7,943. The operating ratio in currency for the whole system was 69.39 per cent. in 1937, against 65·97 per cent. in 1936. There was an increase of 1,138,985 passengers, who brought in receipts of £284,880, an increase of £27,262, of which £15,855 came from first class. In general merchandise, coal, &c., there was an increase of 424,904 tons, although the tonnage of exported coffee fell from 670,919 tons to 586,233 tons. Receipts from merchandise traffic amounted in 1937 to £1,252,274, an increase of £87,922. The average rate of exchange at which remittances were made during the year 1937 was 2·97877d., as against 2·85743d. for 1936. The general financial position is indicated in the accompanying table:—

	1937	1936
	£	£
Gross receipts	1,691,984	1,550,321
Expenditure	1,281,346	1,123,394
Net receipts	410,638	426,927
Income from investments, &c.	318,236	64,523
Total net income	728,874	491,450
Debenture interest and other charges	530,678	278,492
Dividends	170,000	200,000
Brought forward	33,827	20,869
Carried forward	62,023	33,827

Income from investments, &c., in 1937 includes £44,087 transfer from bridge renewal fund, £200,000 transfer from reserve, and £46,687 transfer from rolling stock replacement reserve. Among "other charges" are £200,000 transfer to bridge renewal fund, £88,318 to rolling stock replacement reserve, £56,971 payable to the associated road company under agreement, £51,800 to income tax and N.D.C., and £2,182 to difference in exchange. In 1936 the exchange difference was £31,147, and in 1935 it was £43,702. The transfer in 1937 of £200,000 from reserve to bridge renewal fund is to meet the cost of further expenditure on renewal of bridges between San Paulo and Santos, work which is now in progress. The dividend of 4 per cent. for the year 1937 on the ordinary stock compares with 5 per cent. for 1936, and 2½ per cent. for 1935 and 1934. It is noted in the report that the Mayrink—Santos line of the Sorocabana Railway was provisionally opened to general goods and cattle traffic on December 10, 1937.

* * * *

Bihta Derailment Judicial Inquiry Report

THE report upon the judicial inquiry into the Bihta derailment on the East Indian Railway last July, framed by Justice Sir John Thom, has now been published. Briefly, it finds that the derailment of No. 18 down express was due to distortion of the track caused by "XB" class Pacific locomotive No. 1916 exceeding the prescribed 45 m.p.h. speed limit over 88½-lb. bull-head track during the monsoon season, and consequently hunting; and also that it was directly attributable to negligence on the part of the railway, which is therefore liable to compensate the injured and dependents of the killed. This judicial inquiry which went on practically continuously for four months, and—including judicial and legal costs, the time of a vast number of witnesses of all grades, and incidental expenses—must have cost thousands of pounds, has, therefore, to all intents and purposes, merely confirmed the Senior Government Inspector's opinion.

Turning to details of the judicial report as published in the Indian press, we find that, whilst absolving the driver from all blame for exceeding the 45-m.p.h. limit of speed—at night and with no speed indicator to guide him—it holds that the speed was actually in excess of 50 m.p.h. The engine had been reported by drivers for hunting three times within a fortnight prior to the accident, and the judge was satisfied that it had a tendency to hunt violently. With regard to the track, the report points out that a most thorough, careful, and meticulous examination immediately after the accident revealed nothing to suggest that the track was not up to standard or incapable of bearing the strain of ordinary traffic. Prior to the advent of the "XB" type of engine in 1928, little or no track distortion occurred, but subsequently many cases were reported, and after an accident due to this cause in 1929, all engines of the class were removed from fast passenger services for two years. Distortions recurred with the return of "XB's" to fast service in 1931—though these engines were reported to have been improved in this respect—and it is obvious that they still had a tendency to hunt oftener and more violently than other types.

Regarding the question of negligence, Sir John Thom finds no evidence of negligence in the construction of the new* bank (where distortion occurred), in the maintenance of the track, or in its having been passed as safe for normal speeds. He considers, however, that after a report by the driver of No. 6 down mail, a few hours prior to the derailment of No. 18 down express, of a bad jerk and defective track in the same neighbourhood, there was negligence in that no caution order was issued. The Deputy Controller at Dinapore is held guilty of an error of judgment and of gross dereliction of duty in this connection. But the report contends that the lurch to No. 6 down mail had nothing to do with the subsequent accident, a point which is not clear from the evidence as reported, and in any case, it might be supposed that the issue of a caution order would almost certainly have prevented the derailment. The main charge of negligence is, however, preferred in that the shed staff at Jhajha—the home station of No. 1916—having all its other than "XB" engines either out on line or under repair—used No. 1916 to haul the ill-fated express, in spite of the fact that the the latter in order to keep time had to run at over the 45 m.p.h. speed limit. The Operating Department is held negligent in the manner in which the time-table and engine link system was drawn up, and it is the department rather than the shed staff that is held responsible, the latter being absolved on grounds of ignorance (a point not altogether easy to follow). The administration is also held negligent for not having issued more definite orders about the use of "XB" engines in the face of continued reports upon their hunting. Finally, Sir John considers it his duty to recommend that, in the interests of the public, the design and purchase of "XB" engines should be the subject of a thorough, searching, and independent inquiry.

The "XB" is the medium-weight 4-6-2 Indian standard type of locomotive, and though there was a special speed limit for it on 88½-lb. bull-head track there was none for 90-lb. flat-bottom track, on which there seems to have been no trouble, due, presumably to the lateral stiffness secured by a wide foot. It is to be noted that this is a specific instance in which over 100 lives and as many injuries would probably have been saved had a speed indicator been fitted to No. 1916. If a speed recorder had also been part of the equipment, the driver would hardly have dared exceed the limit, and had he done so, the railway would have been absolved from responsibility,

* A new flood opening had been built at this point a few months earlier

and the heavy cost of compensation and of the judicial inquiry would have been avoided. These instruments are, in fact, a form of insurance against such deplorable disasters, and their universal use, at any rate on passenger services, should be considered an essential measure for the safety of the public in all countries.

* * * *

Radio on the Italian State Railways

THE Italian State Railways have been experimenting with radio apparatus to facilitate train operation. They had, indeed, done so as far back as 1910, but without satisfactory results. When railcar services were introduced it was thought they might be run without ordinary signalling, on the tramway principle, could some means be devised of indicating continuously to drivers their nearness to the preceding car. Tests were accordingly made in the Turin division a few years ago with equipment enabling a musical note to be received on a car, varying in tone according to the distance away of the car in advance, and so forming a kind of continuous, movable, audible block system. The risk of interference with reception, however, was too great for the system to be adopted. In 1933, when severe snowfalls near Bologna interrupted ordinary communication, the management developed a combined 50-watt telephone and telegraph transmitting and receiving unit, compact in size and easily transportable. Some are in regular service for interstation signalling over distances up to 14 miles on the Bologna—Verona line. Wavelengths vary from 152 to 160 m. Further sets of lower power are being made for short distances, for communicating from station to station, or to places where permanent way work is in progress. Since 1924 the wireless time signal from the Eiffel Tower has been instantly relayed by telegraph, and now reaches 3,000 stations daily.

* * * *

Railway

THE great industry of land transport has certainly not been ignored by historians and recorders, although many of the published works on the subject are sadly lacking in accuracy, but among the wealth of available literature a noticeable feature is the fact that most writers have confined themselves within very narrow limits of specialisation, and have left to this day various fields virtually unexplored. One of these fields is that of terminology, for the seeker after knowledge has little apart from general dictionaries to help him. From time to time we have made slight contributions to the subject in these columns regarding the origin of such terms as "fish-plate" and "permanent way," and we were recently impressed with the paucity of information concerning the main word in our own title—namely, "Railway."

Our first definite reference to rail transport in Great Britain—a Wollaton Hall manuscript of 1597—uses the word "rails," and another manuscript in the same collection, dated May 1, 1610, speaks of bringing "coales down the rayles by wagen." In 1606 the word rails was also used in Shropshire, but the obvious step of calling a line of rails a railway does not appear to have been taken. Rather was the way named after its vehicles, for the coal truck with flanged wheels was called a "waggon" as early as the first half of the seventeenth century, and by 1660 we find the line of rails upon which it ran commonly referred to as a "waggon-way." The term persisted for at least a century and a half, and was used by Parliament in 1758 for the first railway it sanctioned, namely, Brandling's line between Middleton and Leeds.

The first use of the word "rail-road" we have been able to trace is in a report of John Smeaton dated April 30, 1774, giving an opinion on the proposed Tyrone Canal; incidentally, this is an earlier reference than any in the New English Dictionary. Smeaton used the term on many occasions, including his description of the "Edystone Lighthouse." In the last-named he referred to the works rail-road he had built at Plymouth in 1756, but as his book was begun only in 1784 and published in 1791 he may have been adopting a term with which he became familiar subsequently. It seems that the word "rail-way" was practically contemporaneous, as its first known use appears to be in the Act of 1776 of the Trent & Mersey Navigation. Of course, both rail-road and rail-way must have become recognised words at this period to have been used in an Act of Parliament and an engineer's report, and it is quite possible that some examination of eighteenth-century manuscripts may reveal further information. On Tyneside, where colliery railways were used most extensively in early years, "waggon-way" continued to be the accepted name until the closing years of the eighteenth century. Two law reports give an indication of the period of transition, one dated 1787 using "waggon-way" only, and another dated 1798 using "rail-ways or waggon-ways." When our oldest predecessor, *The Railway Magazine*, began publication (in 1835), the word had lost its hyphen and become an undisputed unit of the language, but "railroad" was not obsolete in England, nor invariable in the United States. The famous Quincy line in Massachusetts was planned in 1823 as a "rail road," but the company's title (adopted in 1826) was the Granite *Railway* Company. Nicholas Wood's famous treatise was on "Rail-roads," and it was only with the publication of the third edition (in 1838) that *The Civil Engineer & Architect's Journal* remarked: "Railway seems now we think the more usual term."

* * * *

Locomotive and Track

WITH the necessity to provide more powerful locomotives to cope with the tendency towards higher speeds and heavier loads, the relationship between locomotive and track grows in importance, and Mr. D. C. Brown's recent paper to the Institution of Locomotive Engineers on Counterbalancing was timely and revealing. How badly co-ordination between mechanical and civil engineering is needed is stressed by the example quoted by Mr. Brown of 710 bent rails in a distance of 100 miles discovered on the Central of Georgia Railway in 1935, and traced to unbalanced revolving masses in the driving wheels of 2-10-2 locomotives. The first comprehensive indication in this country of what was happening to the permanent way, including bridges, was given by the Bridge Stress Committee's Report of 1928, where hammer blows of nearly 30 tons were being delivered at six revolutions per second, or slightly more than diameter speed. (Diameter speed is reached at 5·6 r.p.m., when the forward speed in m.p.h. equals the diameter in inches of the driving wheels.) Lately much attention has been given to the proportions of reciprocating and revolving masses which it is necessary to balance to provide smooth running, and whereas for long it has been the practice to balance about 60 per cent. of the former, now experience tends to indicate that a very much lower proportion will suffice. After a number of experiments carried out by the South African Railways it was decided to balance only 6 per cent. of the reciprocating masses in the new 2-10-4 "21" Class locomotive,* producing a hammer blow at 50 m.p.h. of only 0·25 ton on any one of the 4 ft. 6 in. coupled wheels. Nevertheless this locomotive is reputed to run quite steadily, as indeed might be expected after

* Described in THE RAILWAY GAZETTE of January 7, page 16

consideration of tests made by the Madras & Southern Mahratta Railway on its "P1" Class 4-6-0 metre gauge locomotives with outside cylinders and 4 ft. 9 in. driving wheels, which, with the reciprocating part entirely unbalanced nevertheless on good road run quite steadily. The conclusion suggested by Mr. Brown's paper is, to use his own words, that "although the couple due to unbalanced reciprocating parts must undoubtedly create a tendency for the locomotive to nose, it would appear that in actual service this cause of nosing is not of practical importance on modern locomotives." If that statement is accepted the way appears to open up to the virtual elimination of hammer blow even in two-cylinder locomotives.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Reducing Coal Consumption

London, S.W.1, April 23

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The circular issued by Mr. Stedman to all enginemen in the North-Eastern Area of the L.N.E.R., which you reproduce in the issue of April 22, is excellent so far as it goes, but might not an intelligent engineman be tempted to retort that if only a few quite small and comparatively inexpensive alterations were made to the front ends of the locomotives as they go into the shops for heavy overhaul, the equivalent of much more than one shovelful of coal every 12 miles could be saved? In fact, in view of the emphasis you have often laid on the importance of the free flow of steam, particularly after it has left the cylinders, it is surprising that so little has been done in this country in the way of improving old engines thus to reduce their coal consumption and increase their power. An editorial on "The Importance of Exhaust" published in your issue of March 18 suggests one very simple way of effecting a saving in coal.

Yours faithfully,

CIVIL ENGINEER

Common Employment

51, Drayton Gardens, S.W.10

April 4

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—In recent years Bills for the abrogation of the Common Law rule of common employment, that a master is not responsible for the negligence of one of his servants which causes harm to another of them, have been defeated. It is difficult to understand the reason for the opposition to such Bills. Of this Common Law rule, first applied in 1837, which has been modified by the Employers' Liability Act, 1880, and by the Workmen's Compensation Acts, 1897-1925, in respect of certain forms of employment, Salmond on the Law of Torts (Eighth Edition by Dr. W. T. S. Stallybrass; page 108) says, "It is irrational, and it is to be regretted that the Legislature has not seen fit wholly to abolish it, instead of merely establishing a series of capricious exceptions to it. The rule is based on the assumption that there is implied in the contract of service between master and servant an acceptance on the part of the servant of all the ordinary risks incidental in such employment, which include the risk of harm done by a fellow servant in the course of common employment." Mr. C. H. S. Fifoot in his "English Law and its Background" says, at page 182, "An assumption, acceptable while industry remained domestic and personal, became meaningless where the master was a limited company controlling thousands of workmen."

The recent case of Metcalfe *v.* The London Passenger Transport Board (*Times* Law Report, April 1, 1938) illustrates the hardship which in fact is still worked by this rule. The plaintiff, a servant of the defendants, was injured through the negligence of a fellow servant, a driver of one of the defendants' tramwaycars, which came into collision with a stationary omnibus belonging to the defendants of which the plaintiff was the conductor. The plaintiff was not successful in his claim for damages from the defendants, who pleaded common employment. It was admitted, however (although only to point out that it had nothing to do with the case), that if the accident had occurred before the passing of the London Passenger Transport Board Act, 1933, the defence of common employment would not have been available, because at that time the plaintiff was in the service of the London General Omnibus Co. Ltd. and the tramwaycar in question belonged to the London County Council.

This rule is not therefore just a harmless relic; nor are objections validly raised to it on academic grounds alone. Its practical sphere of influence increases with every amalgamation. It is to be hoped that yet another Bill for its abolition will be promoted and, this time, passed into law.

Yours truly,

J. P. L. HENDERSON

An Alternative Route to Cambridgeshire and Beyond

198, St. Helen's Road, Hastings, Sussex

April 9

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The connecting link proposed by "Vitesse" from Stapleford on the Hertford loop to Royston on the Hitchin—Cambridge section, L.N.E.R., might become very useful *as such*, but considerable doubts arise as to whether it would be a productive expenditure.

Having lived overlooking the Wood Green junctions for 23 years and studied the traffic continuously up to 1933, I may perhaps be permitted to clear up a few misconceptions regarding the Hertford loop which is still known locally as the Enfield line on account of its original branch character. It is approached from the down fast line at Wood Green by means of two cross-overs, respectively at the south and north ends of Wood Green station, then a curved 1 in 57 rise to carry down trains over the main line. Similarly a curved, sharp descent connects the up loop track with the main route. For the first five miles to Gordon Hill (North Enfield) a heavy suburban traffic is carried on two tracks having five intermediate stations. For some hours during each of the daily rush periods the sections in each direction are practically continuously occupied. A proportion of the local trains run on to Cuffley or Hertford and there is a distinct need for a faster service to and from these points. Eleven freight trains traverse the whole of the loop on a normal weekday. If the line were to be made suitable for fast through traffic on any considerable scale, four tracks would seem essential between Bounds Green Box (Wood Green) and Gordon Hill. As far as I am aware, current plans for electrification affect only the High Barnet, Edgware and Alexandra Palace branches; the greater bulk of main and Enfield line suburban traffic will continue to use King's Cross as at present. The widening of the main line to four passenger tracks as far out as Welwyn Garden City, though an expensive proposition, seems to present a greater urge.

As regards suggested diversion of services, I would make one point. A large percentage of the passengers using the popular King's Cross—Cambridge buffet expresses travel to and from Welwyn Garden City, Hitchin (both useful changing points) or Letchworth: a patronage which these trains have helped to build. If diverted *via* Hertford and such new route all these feeding points would be bye-passed. Cambridge station, also, though an interesting lay-out is not exactly adapted for any great influx of trains at certain periods.

Yours faithfully,

R. A. H. WEIGHT

PUBLICATIONS RECEIVED

"Locomotive Stock Book" Appendix.—The Railway Correspondence & Travel Society has recently published an appendix to its well-known "Locomotive Stock Book." The enlarged form in which the latter appeared last year ran to three impressions, and in view of this and the comparative smallness of the changes during 1937, it was felt by the society that an appendix, giving full details of all such changes, would best meet the case. As in previous issues of the "Locomotive Stock Book," all classes rendered extinct during the year are illustrated, and opportunity has been taken to add a summary of the stock of the principal light railways. The complete list of named engines, also, has been revised and brought up to date. This appendix, published at 1s. 6d., brings the stock book (still obtainable at 2s. 6d.) up to date, and the two used in conjunction provide a complete list of main-line and principal light railway locomotives of Great Britain and Ireland in service at the end of 1937. The two books, if ordered together, may be had for 3s. 9d., post free, from Mr. R. T. Pollock, 102, Disraeli Road, Putney, London, S.W.15.

The Reorganisation of the American Railroad System, 1893-1900. By E. G. Campbell, Ph.D. London: P. S. King & Son Ltd.; New York: Columbia University Press. 6 in. × 9 in. × 1 in. 366 pp. Price 20s. 3d.—To anyone unacquainted with the financial history of the American railways, this book will come as a revelation, and perhaps an unpleasant one. The author has conscientiously and impartially marshalled an array of facts which have the effect, whether intended or not, of presenting us with a most damning indictment of the abuse of financial control of a great public service. The titles of some of the chapters are eloquent in themselves: "Post-War Boom Times and Chaos"; "Over-expansion"; "Past Mistakes"; "Scandals." The post-war time referred to is the period immediately following the American Civil War, which finished in 1865. The boom period was marked by the development of the lines westward to the Pacific coast, aided, it is interesting to recall, by a constant flow of capital from Europe. The year 1869 seems to have witnessed the intensive intervention in railway affairs of "high finance," when Cornelius Vanderbilt gained control of the Lake Shore & Michigan Southern, and by uniting it with his New York Central, formed a trunk line from the Atlantic seaboard to Chicago and the West. Thenceforward, and throughout the period covered by the book, the names of the great American financiers furnish the keynote to the successive phases illustrated. From Vanderbilt in 1869 and Jay Gould in 1873, there is a series of innumerable reconstructions and reorganisations, many of them admittedly little better than financial jugglings.

In many cases the operations of the financiers and the banks under their direction were neither more nor less than a thinly disguised system of what is now known as sharepushing, but on a huge scale. Dr. Campbell puts this very plainly and makes no attempt to gloss over the iniquitous proceedings which kept the greater part of the American railway system, for one decade after another, in and out of the hands of receivers. This was the position in 1893, when a nation-wide depression found the principal railway companies unable to weather the storm, and rendered necessary the reorganisation which forms the theme of Dr. Campbell's book. The last great railroad failure of the depression, that of the Baltimore & Ohio, was in 1896, and the rehabilitation of the companies began then with the intervention of J. P. Morgan, and, a year later, of his great rival, Edward H. Harriman. Almost contemporary with these giants was J. J. Hill, a very different figure, whose well-managed Great Northern line, one of the exceptions to the general rule, had been able to survive the depression. A comparison is inevitable with the railway boom in England at an earlier date, but there are few points of similarity, and the exceptional circumstances which existed in England for a relatively short period, became perennial in the United States. Indeed, it did not end with the date of the reorganisation described in Dr. Campbell's book, but to some extent, unfortunately, continues to recur sporadically, and the account of the collapse of the Erie Company in 1893 has almost a familiar sound today.

Whatever may be the arguments against the principle of State ownership of public utilities, it can hardly be said that the history of the railways of the United States of America is any justification of the advantages of private enterprise, at least, judging from that aspect of them presented in this book. The volume contains a good index and an ample bibliography, but it is difficult to understand why the price should have been fixed at such an odd figure, unusual on this side of the Atlantic, even though it be, as we assume, the exact equivalent of the price in American currency.

Beginselen van Wegenfinanciering in Nederland (Fundamental principles of Financing Road Costs in the Netherlands). By S. A. Reitsma. Reprinted from *De Opbouw*. 47 pp. 9½ in. × 6¼ in. Published by Van Gorcum & Co. Assen. Obtainable from *Spoor- en Tramwegen*, Utrecht. Price 30 cents.—This pamphlet is another of the author's persistent efforts to show the urgency of ending the constant disputes raised by various transport interests concerning their respective contributions to the national welfare. Mr. Reitsma deals with road transport and road costs, it is true, but his arguments are equally applicable in other directions, particularly to the waterways. His object is to disentangle from the numerous funds, methods of taxation, and so on, the true costs and revenue attributable to motor transport, after making due allowance for money invested by the community in roads before the motor era may fairly be said to have begun. The author's general conclusion is that, say from 1920 to 1935 at all events, the costs attributable to motor traffic were probably covered, if all revenue therefrom be considered, but that the very heavy charges arising fron new roads, costlier bridges, traffic signs and signals,and so on, now call for a thorough investigation by an impartial financial expert regarding the likelihood of a deficit in future. The author desires to see eliminated the guesswork and confusion of figures which in Holland, and indeed elsewhere, lead to so much recrimination among interested parties among which the one very much concerned, the ordinary taxpayer, is not organised to make himself heard.

Welding Rods.—A folder from British Insulated Cables Limited, Prescot, Lancs., describes the characteristics of Presap welding rods. These are made of a specially prepared copper alloy designed to reduce the cupric oxide formed during heating, and thereby give a purely metallic weld free from porosity.

Welding Generators.—The Scott K-S welding generator described in a new illustrated catalogue from Lawrence, Scott & Electromotors Limited, of Norwich, is a d.c. machine giving a wide range of current (from 12 to 300 amp.) and a very steady arc at all outputs. It is a bi-polar, cross-field dynamo supplied in its standard form with direct drive from an a.c. motor. A d.c. motor can be fitted if desired, or the generator can be driven by petrol or diesel power, or supplied for connecting to existing shafting. The complete sets may be mounted on a baseplate for stationary installations, or on wheels for transportable service. The current regulator is detachable so that the operator can have it in easy reach when working at some distance from the set.

Surface-Hardened Steels.—Thos. Firth & John Brown Limited, of Atlas and Norfolk works, Sheffield, 1, has issued a revised edition of the booklet dealing with Nitralloy steels. These special steels are surface-hardened in an atmosphere of ammonia gas by a low temperature treatment, acquiring special suitability for work which demands maximum resistance to abrasion, and also for details machined to precision limits. Grades of Nitralloy steels developed in recent years by the company's Research Department contain the elements chromium and molybdenum, but not aluminium, as in the earlier types, and are characterised by possessing a case of lower intrinsic hardness and greater ductility and toughness. With their predecessors, the new grades embrace a range of surface hardness from 600 to 1,100 diamond number.

XUM

THE SCRAP HEAP

Passenger to Dining-Car Attendant (*forte*): "Any celery?"

D.C.A. to Passenger (*pianissimo*): "Very small, sir. We has to rely very largely on tips from generous gents like yourself, sir."

—*From "The Best Railway Stories," published by the Richards Press Limited.*

* * *

Among the greatest of the calamities which a hostile nature visited upon the pioneers of the Western Prairies, were the devastating grasshopper plagues. The great calamity of 1874 surpassed anything before or since. On the plains it is still called "grasshopper year." The hoppers gathered so thick on the tracks that Union Pacific trains were stopped. The rails were so oily and greasy that the wheels spun and would not pull the train.—*From "The Sod-House Frontier," by Everitt Dick.*

* * *

A RENDEZVOUS REGULARISED

The London Passenger Transport Board has attached numbers to the three rows of pillars in the booking hall at Piccadilly Circus Underground station. This plan is to help the many people who arrange to meet their friends in the hall, but have found it difficult to find an easily identified spot as a rendezvous. Previously, there has been the danger of couples pursuing each other round the hall for some time without coming within hailing distance. The new plan should not only assist those for whom it is primarily designed, but save homeward-bound travellers from collisions with distraught suitors.

* * *

HOUSE AND RAILWAY FOR SALE

William Gillette, the actor, who died recently at the age of 83, will probably be remembered chiefly for two things: his creation of the rôle of Sherlock Holmes, and his somewhat fantastic residence which has, winding through the grounds, a complete miniature railway. Gillette not only planned his railway line, but designed his house without benefit of architect or draughtsman. It stands on a hill overlooking the Connecticut River and is built of grey stone with walls at some points four feet thick. Theoretically, the estate is for sale, but it can't just be sold to anybody. For there is a passage in Gillette's will which says: "I would consider it more than unfortunate for me—should I find myself doomed, after death, to a continued consciousness of the behaviour of mankind on this planet—to discover that the stone walls and towers and fireplaces of my home, founded at every point on the solid rock of Connecticut; that my railway line with its bridges, trestles, tunnels, and stone culverts and underpasses, all built for permanence (so far as there is such a thing); that my locomotive and cars, and many other things of a like nature, should reveal themselves to me as in the possession of some blithering saphead who had no conception of where he is or with what he is surrounded. . . . If I were conducting the sale myself, the price for the property would, if necessary, be considerably less to an appreciative customer than to one with no capacity for mechanical enjoyment."—*From The Talk of the Town in "The New Yorker."*

* * *

THE RAILWAY TICKET

Some 700,000,000 railway tickets are printed annually by the British railways in their own ticket printing works. At their face values they represent many thousand millions of pounds. The main features of ticket production adopted by the individual companies are similar, although in respect of certain details their practices differ slightly. The basis of all railway tickets is coloured millboard, which is supplied in sheets, subsequently cut into strips and later into individual tickets measuring 2¾ in. by 1⅞ in. The printing of each side of the ticket is performed as a separate operation, the "Conditions of Issue" being printed first, usually before the millboard is cut into separate tickets. Flat-bed letterpress machines are used for this with an output of 3,000 boards an hour, each board carrying 100 sets of "Conditions."

* * *

INDIAN ANECDOTES

In a book entitled "Tales of Our Grandfather, or India Since 1856" edited by F. & C. Grey, and published in 1912, there are some amusing anecdotes about Indian railways. In 1871-72 a railway was being surveyed from Multan to Karachi. "Through 150 miles of its course in the Bahawalpur State it needed much waterway; but that means expense, and the Government engineers resisted my demands (Col. L. J. H. Grey's). I had an amusing ride over that length with our State engineer; desperate were the struggles between him and the railwaymen, at short intervals, I laughing and pacifying; but they took their own way generally, with the result that their embankment was washed away in the first year of good flood."

In 1878 two young engineers were shipping engines in lighters. "One got away from them and jumped the boat. Did they tear their hair and ask for help? Not a word did they say, but they ran down to Karachi and borrowed a diving suit from the harbour works. Neither had ever dived, but they went into the raging summer Indus, got tackle round their engine (already deep in sand), and raised it. The engines were duly embarked and removed, with so little delay that nothing was known of the matter 'officially.'"

He goes on: "The staff of a new railway are sometimes peculiar. A ballast train of this line was met by a 'materials' train. 'Back out,' said the latter. Not a bit of it; so the 'materials' driver jumped off to report. Instead, however, he hid in the jungle, and presently returned hoping to catch his opponent napping, his stoker having meanwhile kept up steam. But the other fellow had done the same and the locked engines steamed and butted without advantage to either."

Another story he has to tell, is that once a drunken driver could not be dislodged from his footplate, but started off and careered cheerfully till sober.

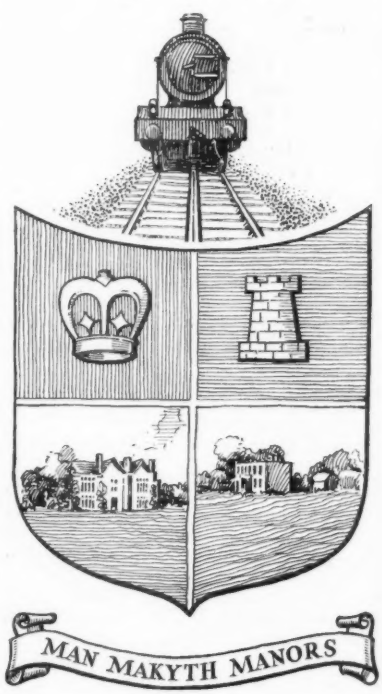
An ex-trooper of a British regiment once made a large fortune by salving rails. "When the Punjab lines were under construction, and rails came up from Karachi by boat, these were frequently lost. He bought the lost cargoes cheap and retrieved them by exertions as wonderful as his profits."

* * *

GERMAN-AUSTRIAN FRONTIER SIGNS

To celebrate the inclusion of Austria in the German Reich motorists from the Bavarian health resort of Bad Tölz brought home with them the frontier signs and the tree trunk which formerly barred the way to Austria at Scharnitz, and placed them in the museum for local folklore at Bad Tölz.

* * *



Crest: Locomotive *rampant*, superheated, proper

Quarterings: One, a King; two, a Castle; three, a Hall; four, a Grange

Suggested heraldic arms for a well-known Chief Mechanical Engineer

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

WESTERN AUSTRALIA

Improvements to the Perth-Kalgoorlie Service

The principal express passenger service operated by the Western Australian Government Railways is that between Perth, the capital city, and the inland mining town of Kalgoorlie, 375 miles distant, and the junction with the Transcontinental Railway operated by the Commonwealth Government of Australia which links Western Australia with the Eastern States of the Commonwealth.

Attention has recently been given to the improvement of the service rendered to travellers on this section, and a number of innovations to this end have been made. For instance, one first class sleeping car has been fitted with a set of auxiliary springs, and Isothermos axleboxes are incorporated in the most recent design of bogie. Supplies of hot water are available to passengers each morning, and a shower bath has been provided in each car, a boon to long-distance travellers in the summer months. Boots and shoes are cleaned by conductors if desired. All first class sleeping cars on this route are now of the two-berth compartment type, and each compartment is complete with wardrobes, washbasin, reading lamps, &c.

Second Class and Dining Cars

The second class sleeping cars originally accommodated six sleeping passengers in each compartment, but the six-berth compartments have now been converted to four-berth, thus adding materially to the comfort of passengers. The seats in second class non-sleepers or sitting cars have been refitted with latex rubber cushions with consequent increase in comfort for long-distance travellers. Dining cars are provided on this route, and have been reconditioned throughout, and the interiors brightened, so that they now present a more attractive appearance to travellers. Progressive improvements similar to the above are being made on other main-line services throughout the system.

NEW ZEALAND

New Type of Second Class Express Car

The first of the new second class cars now being turned out from the railway workshops at Otahuhu (Auckland) ran their trials in December last, and several are now in regular service. Each car is 6 ft. longer than the usual main trunk type of second class car and seats 56 instead of only 44 passengers. The tare weight per passenger is 9 cwt. 3 qr. 16 lb. as compared with nearly 12 cwt. for former North Island cars and 14 cwt. for South Island cars of the same class.

These new cars have a length of 56 ft. and a wheelbase of 42 ft., and their tare weight is 27 tons 14 cwt. each. All the bogies are fitted with roller bearings. They have been designed so that they may be used in either the North Island or the South, and are equipped with automatic couplers and vestibules that permit of communication between the cars without passengers being exposed to the weather.

Brown Rexine has been used in the finish of the interior walls, and, as mouldings have been reduced to a minimum, the cars will be more easily kept clean. The lower part of the ceiling, immediately behind the luggage racks, is covered with mottled brown rubber, to protect the ceiling from damage by luggage, and the arch of the ceiling is covered with white Rexine. The chairs, which are placed four abreast with a central gangway, are of the standard Scarrett type, the seats being fitted with Dunlopillo units and the backs padded with Hairlok. The whole chair is covered with antique red leather.

The roof of the car is of copper-faced plywood and all joints are covered with metal strips. The standard fittings similar to those used on other main trunk cars, include electric light, Westinghouse water raising system, steam heating, emergency brake apparatus, &c. This type of car is to be standard in future for use on the main lines.

RHODESIA

Continued Traffic Increases

At the recent Congress of the Chambers of Commerce, Sir Henry Chapman, then General Manager of the Rhodesia Railways, after reviewing the record financial results for the year 1936-37, stated that in the first four months of the current financial year, October to January, the revenue had continued to be buoyant. The total earnings were up by over £400,000 and the net operating revenue was higher by £136,000. General goods traffic was still increasing but a continuance of this state of affairs could hardly be expected, and Sir Henry said that he would be more than satisfied if the net operating revenue for this year approximated to that of the previous year.

Discussing the possibilities of rates reductions, the General Manager stated that the time was fast approaching when the reserve accounts would reach twice the annual loan provision, and a reduction in rates would then be possible. No specific reduction of rates would be made until the reserve account reached the amount fixed, and it was improbable that reductions would come into operation before October 1, 1939. For the year 1936-37 the amount carried to reserve would be £863,688, bringing the total in this account up to £1,675,657 or roughly one and half times the loan provision.

Extension of Railcar Services

The extension of railcar services was urged at this Congress, and the General Manager stated that consideration was being given to the purchase of three large and three smaller railcars. A large car would be placed on the Salisbury—Shamva branch, at present served by a Ganz diesel railcar, described in THE RAILWAY GAZETTE of October 30, 1936, which vehicle is now too small for the traffic offering. It was proposed to put a second large railcar on the Bulawayo—West Nicholson branch line, and other cars were being considered for the Salisbury—Sinoia, and Gwelo—Fort Victoria branches, and on branch lines serving the Copperbelt in Northern Rhodesia.

Record Year at Port of Beira

The heavy traffics carried by the Rhodesia Railways in the year 1936-37 led to all records being broken at the port of Beira; the tonnage handled there in the last two years is given below:—

	Years ended Sept. 30, 1937 Harbour tons	1936 Harbour tons	Increase Harbour tons
Landed ...	417,559	298,798	118,761
Shipped ...	885,866	598,715	287,151
Total ...	1,303,425	897,513	405,912

Of this increase, amounting to 45·2 per cent., over 64 per cent. was concentrated in the last six months of the year. The tonnage dealt with was easily a record for the port, as the previous best year was 1930, when 1,014,748 harbour tons were handled. From March, 1937, traffic began materially to increase, and the record month so far was September with a tonnage of 169,002. Comparing the eleven months March, 1937, to January, 1938, with the previous eleven months, the tonnages showed an increase of 62 per cent. landed, and 40 per cent. shipped. As at most other African ports there have been traffic congestion and some delays in handling import traffic. Steps have been taken to clear up the position, and the arrival of a large number of new trucks will, it is hoped, avoid a recurrence. The present three-berth deep-water wharf is being extended by a further two berths, and additional transit sheds are to be constructed to cope with heavier traffics.

New Works

With the increased train service a number of new crossing loops and extensions to existing crossing facilities has been authorised recently, which will permit the acceleration of trains and eliminate the need for splitting trains when effecting crossings. In

addition, several deviations to ease curves on the main line will assist train running and secure a greater measure of safety.

The new station at Umtali, the eastern entrance to Southern Rhodesia, is nearly completed and the General Manager recently announced that there were other important works in view, including the completion of Salisbury station improvements, Gwelo station, and a new station at Beira.

ARGENTINA

Institute of Transport (Argentine & River Plate Centre)

The annual general meeting of this centre was held in Buenos Aires on February 22. Mr. J. G. Mayne, Managing Director, Percy Grant & Co. Ltd., presided. The report on the past year's work and statement of accounts were submitted and approved. There are 213 members and students on the roll. During the session, papers had been read by the Chairman, and by Messrs. M. F. Ryan, H. E. Pheasant and P. L. Falconer. Visits had been paid in April to the Rio Negro valley, in June to El Mundo radio station, and in August to Tucumán, where the hydro-electric station and sugar-cane factories were inspected. The Chairman's prize, consisting of a set of books to the value of $50, for the best paper submitted during the session by non-corporate members of the institute, was awarded to Mr. P. E. Jefferey (Graduate), Traffic Department, B.A.P.R., for his paper on "Railway Collection and Delivery Service." The following committee was elected for 1938:—

Chairman: Mr. C. R. S. Harris; Vice-Chairmen: Messrs. G. C. Bonner and T. C. S. Haslam; Secretary: Mr. A. C. Wren; Treasurer: Mr. J. A. Meelboom (re-elected); members: Messrs. F. A. Bottomley, K. Marshall, Ll. W. Makin, A. S. Matthews, H. G. Beckwith, E. A. Richards and F. C. Egerton. Messrs. Deloitte, Plender, Griffiths & Co. were re-elected honorary auditors.

Poor Harvest Prospects

The depressing financial outlook before the Argentine railways, with which 1938 has opened, has not been made any brighter by the pessimistic forecast of the present year's harvest issued by the Ministry of Agriculture. According to the latest official estimates, 40 per cent. of the area sown with maize, particularly in the province of Cordoba, the western zones of the Province of Buenos Aires, the Pampa territory, and the centre and north of the Province of Santa Fé may be regarded as totally lost, owing to frosts, drought and the ravages of locusts. The area sown is estimated at 6,145,000 hectares (15,362,000 acres) or 318,900 hectares (972,500 acres) 4·9 per cent. less than last year, and 559,074 hectares (1,397,685 acres), 8.3 per cent. below the average for the last five years. Although this second estimate is some 195,100 hectares (488,000 acres) higher than the first forecast issued in January last, the increase is of little importance, in view of the extensive area lost.

Wheat and Linseed

According to the second official forecast issued on February 25, the production of wheat is estimated at 21 per cent. and that of linseed at 18·9 per cent. less than last year, and 4·1 and 5 per cent., respectively, as compared with the first estimate issued in December and as published in THE RAILWAY GAZETTE of February 4. The official estimates of the four principal crops are as follow: wheat 5,009,000 tons, linseed 1,505,300 tons, oats 689,900 tons, and barley 515,900 tons.

CHILE

Proposed Transport Co-ordination

According to advices from Santiago, a special commission appointed by the Municipality to study the problem of urban transport, has reported in favour of the creation of a single corporation with an autonomous organisation, to operate the city's transport services as a public utility body.

SWEDEN

Organisation of the State Railways

Before his retirement from the post of General Manager of the Swedish State Railways (recorded in THE RAILWAY GAZETTE of February 4), Herr Axel Granholm gave an address to the Northern (Scandinavian) Association at Lübeck on the organisation and working of the system. He said that in Sweden, a country roughly equal in length to the distance from North Germany to Southern Italy and with a relatively small population, the State Railways were the largest business concern. On the completion of the Inland line in the summer, their mileage amounted to 8,000 km. About $\frac{2}{3}$ of the capital value of the railways, or some kr. 850 million, originated from State loans, for the interest on which the taxpayer was liable; the remaining 500 millions were represented by lines constructed to help outlying parts and yielding little remuneration. In 1936, a good year in which about 27,500 persons were employed, operating costs and renewals came to 171 millions, leaving a surplus of 40 millions. The General Manager was directly responsible to the King. The railways were, therefore, free from party considerations and were administered independently. Apart from general transport legislation and executive and staffing matters, Parliament decided only on new works, which the management had proposed to the King, and was not concerned with timetables and regulations.

The increases over the figures for 1913 (60 per cent. more mileage; 80 per cent. more traffic) and a policy of higher wages with shorter hours, had meant only a small addition to staff. Since the beginning of road competition, economic policy had been aimed at rationalisation. The problem of the many small private lines, with their different wage policies, could be solved only by forming a common system of management, with the State Railways as the principal participant. Sweden would shortly have half her lines electrified, but the advantages of the increased maximum speed of the electric locomotives could be gained only by strengthening the permanent way, which they were now doing on the more important routes. The fares, worked on a progressive zone system, were cheap; a journey of over 1,200 miles cost only 45 kronor. High speeds and ultra-luxurious trains were not in demand, and the administration, on whose lines only two persons had been killed in train accidents in the last two years, was concentrating on improving the accommodation for the third class passengers, who contributed $\frac{4}{5}$ of the passenger revenue.

TANGANYIKA

Government Railways in 1937

The approximate revenue earnings of the Government Railways and lake steamer services during 1937—and for comparison during 1936 also—were as under, as are also details of import and export tonnages railed over the two lines:—

Earnings	1936	1937	Increase or decrease
	£	£	£
Coaching	99,174	119,149	+ 19,975
Goods	537,980	556,013	+ 18,033
Telegraph and sundries	19,679	20,972	+ 1,293
Steamship service on Lake Tanganyika	4,778	5,657	+ 879
Total	661,611	701,791	+ 40,180

Line	Imports			Exports		
	1936	1937	Increase or decrease	1936	1937	Increase or decrease
	Tons	Tons	Tons	Tons	Tons	Tons
Central	99,031	108,627	+ 9,596	108,990	114,799	+ 5,809
Tanga	35,836	46,983	+ 11,147	78,299	95,652	+ 17,353

THE RAILWAY POSITION IN ARGENTINA

A brief survey of the financial results on the British-owned railways during the half-year July-December, 1937, and the present worsening position which has led to the request by certain lines to re-institute wage-cuts

(From our Buenos Aires correspondent)

A STATISTICAL analysis of the working results of all the privately-owned Argentine railways during the financial half-year, July—December, 1937, just issued by the *Instituto de Estudios Económicos del Transporte*, shows that, due to the heavy slump in goods traffic, the net receipts on all the lines during the period referred to declined by some $11,700,000 paper or 5·2 per cent., as compared with the corresponding period of 1936. With a few exceptions, the passenger receipts showed an improvement, amounting in all to $1,864,000, or 4·5 per cent. Over six million (8·9 per cent.) more passengers were carried during July—December, 1937, than in the corresponding period of 1936, the heaviest movement being registered by the B.A.G.S.R. with a total of 27,987,000 passengers, an increase of 2,989,000 (12 per cent.). The Central Argentine was next with 25,770,000, an increase of 1,645,000 (6·8 per cent.), then the B.A.W.R. with 11,917,000, an increase of 972,000 (8·9 per cent.), and the B.A.P.R. with 7,143,000 (670,000 more, or 10·4 per cent.). The following comparative table shows the passenger receipts of the different lines during the first six months of 1937-38 and 1936-37, respectively, the figures representing thousands of $ paper:—

	Passenger Receipts 1937–38	1936–37	Percentage Inc. or Dec.
Southern	14,452	13,293	+ 8·7
Central Argentine	13,961	14,052	— 0·6
Western	5,013	4,555	+10·1
Pacific	4,671	4,225	+10·6
Cordoba Central	1,606	1,699	— 5·5
Entre Rios	903	895	+ 0·9
Argentine N.E.	870	831	+ 4·7
Santa Fé Prov.	578	662	—12·7
Compañia General	355	404	—12·1
Cent. of Buenos Aires	749	689	+ 8·7
Rosario Puerto-Belgrano	128	117	+ 9·4

The improvement in the passenger returns was, however, more than offset by the decline in goods traffic, which fell from 21,602,000 to 19,551,000 tons, a reduction of 2,051,000 tons or 9·5 per cent., and the receipts dropped from $158,533,000 paper in the corresponding period of 1936-37 to $146,217,000, a decrease of $12,316,000, or 7·8 per cent. The appended tables show the goods tonnage and goods receipts—in thousands of tons and thousands of $ paper respectively—of the various railways during the period under review, as compared with that of 1936-37:—

	Goods Tonnage 1937–38	1936–37	Percentage, Inc. or Dec.
Southern	5,551	5,336	+ 4·0
Central Argentine	5,059	6,656	—24·0
Pacific	2,097	2,220	— 5·5
Western	1,858	1,702	+ 9·2
Cordoba Central	1,528	1,772	—13·8
Entre Rios	518	491	+ 5·5
Argentine N.E.	270	255	+ 5·9
Santa Fé Prov.	983	1,151	—14·6
Compañia General	843	946	—10·9
Cent. of Buenos Aires	440	537	—18·1
Rosario-Puerto Belgrano	404	536	—24·6

	Goods Receipts 1937–38	1936–37	Percentage Inc. or Dec.
Southern	33,665	32,741	+ 2·8
Central Argentine	38,857	46,915	—17·2
Pacific	26,495	27,465	— 3·5
Western	12,856	13,028	— 1·3
Cordoba Central	10,704	12,052	—11·2
Entre Rios	4,237	4,065	+ 4·2
Argentine N.E.	3,078	3,014	+ 2·1
Santa Fé Prov.	6,313	7,662	—17·6
Compañia General	5,637	6,291	—10·4
Cent. of Buenos Aires	2,195	2,653	—17·3
Rosario-Puerto Belgrano	2,180	2,647	—17·6

The aggregate total revenue, inclusive of miscellaneous receipts, of all the lines during the six months under review amounted to $211,200,000 paper, as compared with $222,895,000 for the corresponding period of 1936, a reduction of $11,695,000, or 5·2 per cent. The following table shows the increase or decrease of each company during the period under review, also in thousands of $ paper:—

	Increase or Decrease in Total Receipts
Southern	+ 1,542
Central Argentine	— 8,571
Pacific	— 716
Western	+ 146
Cordoba Central	— 1,411
Entre Rios	+ 215
Argentine N.E.	+ 107
Santa Fé Prov.	— 1,397
Compañia General	— 769
Cent. of Buenos Aires	— 385
Rosario-Puerto Belgrano	— 456

The following is a summary, in thousands of $ paper, of the operating results of all the companies during the first six months of the financial year 1937-38, as compared with the corresponding period of 1936-37:—

	1936–37	1937–38	Inc. or Dec. in 1937–38 Absolute	Percentage
Goods				
Tons	21,602	19,551	— 2,051	— 9·5
Ton-km.	5,353,055	5,252,086	—100,969	— 1·9
Passengers				
Number	70,602	76,860	+ 6,258	+ 8·9
Pass.-km.	1,833,986	1,972,821	+138,835	+ 7·6
Receipts				
Passengers	41,422	43,286	+ 1,864	+ 4·5
Goods	158,533	146,217	— 12,316	— 7·8
Miscellaneous	22,940	21,697	— 1,243	— 5·4
Total receipts	222,895	211,200	— 11,695	— 5·2

Since December 31, however, the position has rapidly deteriorated, and the railways are faced with a very serious financial situation. As it is growing worse every week, the companies would seem to have no alternative but to re-establish the salary and wage-cuts which were imposed during the crisis in 1932, with a view to reducing working expenses.

On April 1, the managements of the B.A.W. and B.A.P. Railways notified the National Railway Board that, for the reason given, they had decided to introduce salary and wage-cuts as from that date. The B.A.W.R. proposals provided for a 5 per cent. reduction all round,

XUM

irrespective of grades or categories, but the B.A.P.R. intimated that it intended to reduce all salaries by 10 per cent., with the exception of those of employees whose rate of remuneration did not exceed $120·00 a month, when the reduction would be 6·66 per cent., and in the case of those earning $115 a month and under that sum, 3·3 per cent. The B.A.P.R. drew the attention of the National Railway Board to the fact that its goods receipts during the present financial year had, by the end of March, fallen by as much as $3,200,000 paper below those for the corresponding period of 1936-37, and that it was estimated that by June 30 the deficit would amount to not less than $5,000,000.

The companies' proposals at once aroused the opposition of the two railways unions, the *Union Ferroviaria* and *La Fraternidad*, each of which immediately called meetings to discuss the situation and decide what action should be taken to resist the proposed reductions. A delegation representing both bodies also sought an interview with President Ortiz to submit their views on the question, one of their arguments—which was refuted—being that, under the terms of President Justo's Arbitral Award of October, 1934, three months' notice must be given before any reduction in wages could be put into force. The President promised to discuss the matter with the Minister of Public Works.

Meanwhile the employees of the railway workshops at Santos Lugares and the Stores Department of the B.A.P.R., took direct action, and without the authority of their union, declared a 10-minute stoppage of work on April 8. In view of the illegality of this procedure, the company at once suspended the personnel affected—some 1,500 men—for the rest of the day. Despite this strong action on the part of the railway authorities, the agitation continued to spread, and without instructions from the unions, there have been cases of isolated action such as "working to rules," by way of protest against the company's proposals.

Finally, on April 14, it was announced that the Government had decided that the B.A.W.R. and B.A.P.R. were entitled to make the proposed reductions. The resolution on the subject issued by the Ministry of Public Works pointed out that the projected wage cuts were in accordance, both in the spirit and the letter, with President Justo's Award, under the provisions of which the B.A.P.R. was really entitled to effect deductions amounting to $928,045 during the financial year ending June 30 next, whereas the proposed reductions would represent an economy of only $776,542 during the remaining quarter of the present financial period. The working results of the railway for 1937-38 were given as under:—

	$ Paper
Receipts	77,418,860
Working expenses, renewals, exchange loss on imported materials, and debenture services	71,277,345
Net receipts	6,141,515
Exchange losses on debenture services	5,600,000

In view of the foregoing figures, the B.A.P.R. was authorised to enforce cuts in salaries and wages as detailed above. In addition, short time would be established for the workshop staff at the rate of 43½ hr. a week, with the exception of the Mendoza shops, where the period was fixed at 41 hr., and at 46½ hr. in the carriage and machine tool sections at Junin.

With regard to the unions' contention that wage cuts could not be enforced until three months' notice had been given, the Minister of Public Works denied that any such interpretation could be placed on the provisions of the award, as this would render the whole scheme inapplicable. A similar resolution was issued in connection with the Western Railway, but the text was not issued for publication.

It should be pointed out that bad as is the situation of these two lines, they are by no means the worst off with regard to receipts, this unenviable distinction belonging to the Central Argentine, the aggregate returns of which up to the week ending April 9, show a decrease of 22 million pesos below those of the corresponding period of 1936-37, while all the other lines, with the exception of the Entre Rios and Argentine N.E., also show heavy deficits. For this reason, it is difficult to see how the other companies can avoid adopting similar measures.

FERRIES AND BRIDGES IN DENMARK*

A review of the means of communication between the mainland and the islands of Denmark

UNTIL quite recent years communication between the various parts of Denmark, separated by water, was mostly carried on by means of ferries. Of late the tendency has been to replace the ferries by bridges where this has been technically and economically feasible. Thus not only is the tiresome transference of passengers and vehicles associated with ferry services avoided, but also the hindrances frequently occasioned by the weather, which are often considerable in winter and may even lead to a total suspension of the service. These difficulties are felt disproportionately on short journeys, more especially where the traffic is heavy.

The most important ferry routes are, or were:—

Denmark–Sweden

The Copenhagen-Malmö service, and the Helsingør (Elsinore)-Hälsingborg service, started respectively in 1895 and 1892, both worked jointly by the Danish State and Swedish State Railways.

Denmark–Germany

The Storstrøm route, opened in 1884 between Masnedo and Orehoved, replaced by the new bridge this year, and the North Sea route between Gedser and Warnemünde, opened in 1903 and worked jointly with the German State Railway.

Connecting the Provinces of Seeland, Funen, and Jutland

The Great Belt service, opened in 1883 between Korsør and Nyborg, and the Little Belt service, opened in 1872 between Strib and Fredericia, but replaced by a bridge in 1935. There are also two short ferry routes in Jutland over the Limfjord, namely:—

The Oddesund ferry, opened 1883 on the Struer-Thisted section; and the Sallingsund ferry, opened 1889, on the Skive-Nykøbing Mors section.

All these services convey railway vehicles (passenger and freight) and motor vehicles; the Great Belt ferries have three tracks, the others one track. The State Railways also operate some ferry and boat services which carry motor vehicles only, between Elsinore and Hälsingborg, Korsør and Nyborg; and across the Kattegat between Kalundborg and Aarhus, opened in 1914.

From 1883 to the outbreak of the war the Danish and Prussian railways jointly operated a postal and passenger steamer service between Korsør and Kiel.

In addition to the State Railways services, there are

* From an article by Mr. C. Munck Petersen, Engineer, Danish State Railways, in the *Zeitung des Vereins Mitteleuropäischer Eisenbahn Verwaltungen*

several others in the hands of private undertakings, sometimes supplementing, sometimes competing with, the others. The most important of these, chiefly conveying motor vehicles, run between :—

Dragør and Limhamn (Malmö) parallel to Copenhagen-Malmö.
Elsinøre and Hälsingborg.
Hundested and Rørvig.
Hundested and Grenaa.
Kalvehave (Seeland) and Koster (Møen).
Møen-Falster (over the Grønsund).
Nakskov (Lolland) and Spodsbjerg (Langeland).
*Rudkøbing (Langeland) and Svendborg (Funen).
Svendborg (Funen) and Vindeby (Taasinge).
Vemmenaes (Taasinge) and Rudkøbing.
*Svendborg and Aerøskøbing (Aerø).
*Faaborg (Funen) and Mommark (Alsen).
Assens (Funen) and Aarøsund (Schleswig).
Esbjerg to Fanø.

There was at one time a Middlefart and Snoghøj route, closed when the Little Belt bridge was opened.

It is not surprising, seeing the importance of these ferries, over which considerable traffic passes, that plans were early brought forward for bridges in numerous places. Among the older and larger bridges the following deserve mention :—

The Limfjord railway bridge—between Aalborg and Nørresundby, opened in 1879.

The Masnedsund railway bridge—opened in 1884 simultaneously with and on the route of the Storstrøm ferry.

The Guldborgsund railway bridge—between Falster and Lolland on the privately owned Nykøbing Falster-Nakskov line. A road bridge had been built at this place in 1867, with swing portion, while a number of other road bridges, built as floating bridges on boats, were put up about that time, such as the Limfjord bridge, opened in 1865 from Aalborg to Nørresundby; the Roskilde bridge near Frederikssund; and the Alssund bridge near Sonderburg. These, with the Mariager Fjord bridge of 1904 near Hadsund, were until 1928 the only large bridges over stretches of water, the plans made by the State Railways between 1886 and 1889 for bridges over the Little Belt and Storstrøm having come to nothing; but during the last 10 years the development of both rail and road traffic, especially the latter, has led to the building of a number of bridges, or to some being begun, as follows :—

1. The railway bridge over the Roskilde Fjord near Frederikssund, opened in 1928 for the new line from that place to Ringsted. (This was closed again in 1936 and the bridge material is being used for the new Limfjord railway bridge.)

2. The Alssund road and railway bridge of 1930, near Sonderburg, replacing a floating bridge.

3. The Limfjord road bridge of 1933, from Aalborg to Nørresundby, also replacing a floating one.

4. The road bridge over the Guldborgsund between Falster and Lolland, opened in 1934 and replacing a very primitive ferry service.

5. The Little Belt road and rail bridge† opened in 1935, replacing two ferries.

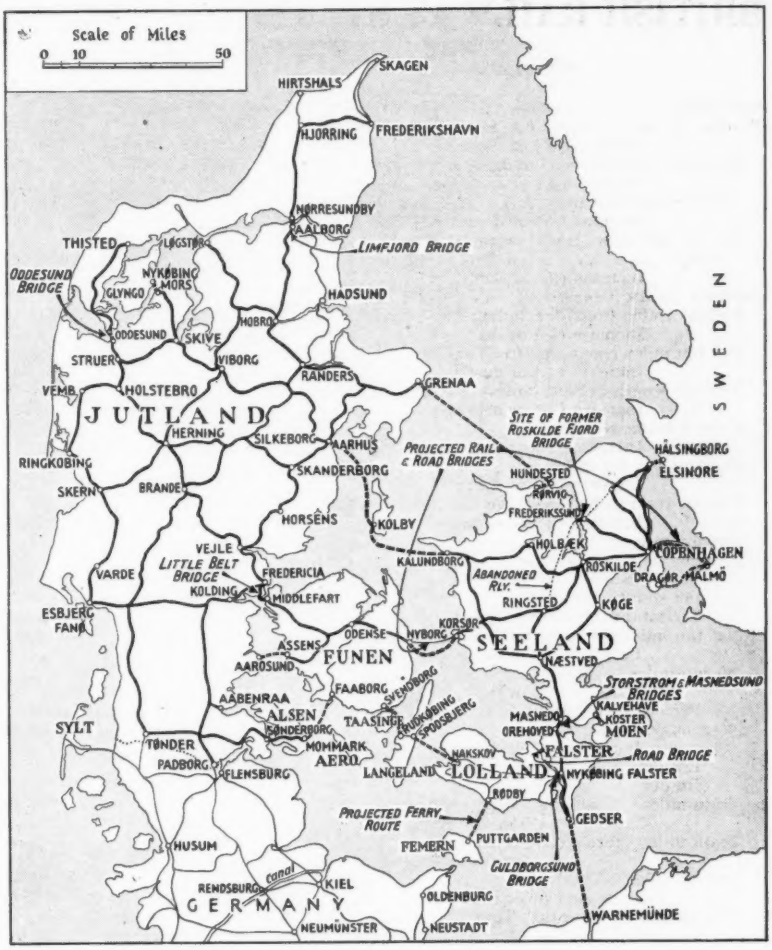
6. The Roskilde road bridge of 1935, replacing a floating one.

7. The rail and road bridge over the Storstrøm, opened in 1937.†

8. The road and rail bridge over the Masnedsund, part of the No. 7 scheme, replacing the old railway bridge, used latterly also for motorcars between trains.*

9. The Limfjord rail and road bridge near Oddesund, begun in 1934, and to be opened on May 15.*

10. The new Limfjord railway bridge (to replace the old bridge between Aalborg to Nørresundby) opened on April 23.



Sketch map showing Danish ferries and bridges

A considerable number of other plans for bridges—mostly road bridges—is under consideration or being worked out, some examples being :—

A Vildsund bridge between Mors and Thy.
An Aggersund bridge near Løgstør.
A bridge over the Ulvsund between Seeland and Møen.
A bridge over the Svensborgsund between Funen and Taasinge, and another over the Sio-Sund between Taasinge and Langeland.

A private undertaking has come forward with plans for a network of national motor roads, similar to the German *Autobahnen*, with combined road and rail bridges† across the Oresund (Copenhagen-Malmö) and Great Belt (Halskov-Knudshoved), with ferry or bridge over the Fehmarn Belt, between Rødby and Fehmarn, making connection with the German roads from Lübeck to Hamburg, Bremen, and Cologne, but nothing can as yet be stated as to the future of the scheme.

* Railway vehicles also carried
† Described in THE RAILWAY GAZETTE of October 22, 1937

* Described in THE RAILWAY GAZETTE of October 22, 1937
† The scheme was described in THE RAILWAY GAZETTE of April 10, 1936

BRITISH RAILWAY STATISTICS

"The Railway Gazette" monthly table for Jan., 1938, as compared with Jan., 1937, compiled from the Ministry of Transport Statement No. 218

Description	Great Britain*	G.W.R	L.N.E.R.	L.M.S.R.	S.R.
PASSENGER TRAIN TRAFFIC—					
Number of pass. journeys (ex. season ticket holders)	102,650,979	6,577,279	13,909,986	22,267,295	17,839,650
Increase (+) or decrease (—)	+ 2,745,812	— 110,162	+ 202,645	+ 272,605	+ 768,692
Passenger receipts (excluding season ticket holders)	£3,509,159	£424,378	£679,625	£1,025,741	£780,139
Increase (+) or decrease (—)	+ £204,805	+ £18,760	+ £42,944	+ £73,240	+ £42 214
Season ticket receipts	£1,080,046	£70,202	£200,959	£277,926	£346,505
Increase (+) or decrease (—)	+ £81,872	+ £4,533	+ £16,446	+ £19,227	+ £26,050
Parcels and misc. traffic receipts (excluding parcels post)	£984,997	£180,318	£313,577	£365,387	£108,980
Increase (+) or decrease (—)	+ £27,926	+ £9,436	+ £8,635	+ £10,820	+ £465
FREIGHT TRAIN TRAFFIC—					
Freight traffic (tons) (excluding free-hauled)	22,721,685	5,374,846	10,385,171	10,745,836	1,254,026
Increase (+) or decrease (—)	+ 407,875	+ 14,553	+ 330,098	+ 257,750	— 29,709
Net ton-miles (excluding free-hauled)	1,336,376,500	246,187,935	447,078,194	555,946,352	50,977,727
Increase (+) or decrease (—)	+ 50,126,329	+ 4,101,639	+ 15,474,143	+ 31,707,267	— 1,463,852
Average length of haul (miles) (excluding free-hauled)	58·82	45·80	43·05	51·74	40·65
Increase (+) or decrease (—)	+ 1·18	+ 0·64	+ 0·13	+ 1·76	— 0·20
Freight traffic receipts	£7,192,252	£1,179,046	£2,461,311	£2,950,000	£370,076
Increase (+) or decrease (—)	+ £301,757	+ £1,772	+ £206,311	+ £78,000	+ £7,355
Receipts per ton-mile	1·292d.	1·15d.	1·32d.	1·27d.	1·74d.
Increase (+) or decrease (—)	+ 0·006d.	— 0·02d.	+ 0·07d.	— 0·04d.	+ 0·08d.
Freight train-loads : Average train-load (tons)	131·49	136·75	135·89	130·68	101·47
Increase (+) or decrease (—)	+ 3·64	+ 3·03	+ 2·39	+ 5·40	+ 0·44
Net ton-miles—					
Per train engine-hour	922·67	1,001·39	984·09	868·32	757·90
Increase (+) or decrease (—)	+ 7·83	+ 8·19	— 25·05	+ 32·11	— 26·49
Per shunting-hour	886·96	805·47	980·48	917·49	557·35
Per total engine-hour	452·23	446·40	491·14	446·12	321·17
Net ton-miles per route-mile per working day	3,063	2,995	3,257	3,687	1,136
Increase (+) or decrease (—)	+ 243	+ 167	+ 255	+ 367	+ 11
Wagon-miles. Total	362,749,124	64,903,217	127,655,217	153,531,495	16,305,796
Increase (+) or decrease (—)	+ 1,400,959	— 1,495,580	+ 1,666,913	+ 2,404,736	— 857,248
Percentage of loaded to total	65·38	66·46	63·41	66·52	65·76
Wagons per train. Total	33·76	33·69	34·24	33·84	30·52
Increase (+) or decrease (—)	— 0·21	— 0·52	— 0·32	— 0·01	— 0·50
Loaded	22·07	22·39	21·71	22·51	20·07
Empty	11·69	11·30	12·53	11·33	10·45
Train-miles. Coaching—Per train-hour	15·07	14·05	14·25	14·19	17·97
Per engine-hour	12·13	11·15	10·99	10·94	15·26
Train-miles. Freight—Per train-hour	8·26	8·89	8·54	7·75	9·12
Per engine-hour	3·44	3·29	3·67	3·41	3·12
Engine miles. Total	47,103,441	7,517,340	13,168,735	17,493,924	6,131,428
Increase (+) or decrease (—)	+ 481,988	— 8,107	+ 261,326	+ 227,734	+ 28,804
Mileage run by engines. Total train-miles—					
Coaching	23,095,020	3,153,095	5,337,790	7,349,516	4,608,575
Freight	10,745,600	1,926,323	3,728,455	4,537,259	534,204
Engine-hours in traffic. Total	5,233,480	897,173	1,575,691	2,085,146	490,095
Increase (+) or decrease (—)	+ 63,742	+ 708	+ 52,199	+ 20,158	— 6,910
Shunting miles per 100 train-miles—					
Coaching	7·36	7·10	6·69	7·87	7·75
Freight	73·64	84·35	67·98	69·92	93·86

Passenger Traffic Statistics: Number of journeys, receipts, and receipts per journey (excluding season ticket holders)—January, 1938

Subject	Great Britain	G.W.R.	L.N.E.R.	L.M.S.R.	S.R.	Cheshire Lines	Liverpool Overhead	L.P.T.B.†	Mersey
Full fares—									
Pass. journeys	34,606,237	644,974	1,083,906	1,325,081	2,754,407	13,066	176,579	27,740,566	84,425
Gross receipts	£881,579	£67,715	£113,032	£114,693	£192,657	£2,354	£1,874	£373,745	£1,458
Receipts per pass.	6·11d.	25·20d.	25·03d.	20·77d.	16·79d.	43·24d.	2·55d.	3·23d.	4·14d.
Reduced fares—									
Excursion and week-end—									
Pass. journeys	36,128,735	3,603,352	8,215,342	12,268,431	8,262,181	403,850	80,996	1,573,520	710,619
Gross receipts	£1,864,835	£277,032	£421,278	£657,641	£415,780	£19,770	£790	£32,788	£10,087
Receipts per pass. journey	12·39d.	18·45d.	12·31d.	12·87d.	12·08d.	11·75d.	2·34d.	5·00d.	3·41d.
Workmen—									
Pass. journeys	28,487,378	1,910,129	3,849,348	7,641,901	6,133,038	278,714	274,646	7,210,280	260,258
Gross receipts	£425,085	£29,058	£64,362	£126,689	£102,186	£4,748	£2,407	£81,810	£2,275
Receipts per pass. journey	3·58d.	3·65d.	4·01d.	3·98d.	4·00d.	4·09d.	2·10d.	2·72d.	2·10d.
Other—									
Pass. journeys	3,423,028	417,726	760,258	1,029,150	689,441	27,353	56,948	373,764	10,206
Gross receipts	£329,546	£49,215	£79,283	£122,289	£68,906	£3,528	£388	£3,333	£171
Receipts per pass. journey	23·11d.	28·28d.	25·03d.	28·52d.	23·99d.	30·96d.	1·64d.	2·14d.	4·02d.
Total—									
Pass. journeys	102,650,979	6,577,279	13,909,986	22,267,295	17,839,650	723,035	589,169	36,898,130	1,065,508
Gross receipts	£3,509,159	£424,378	£679,625	£1,025,741	£780,139	£30,442	£5,459	£491,676	£13,991
Receipts per pass.	8·20d.	15·49d.	11·73d.	11·06d.	10·50d.	10·10d.	2·22d.	3·20d.	3·15d.

* All standard gauge railways

† Includes passengers originating on the railway undertakings, and on the Whitechapel and Bow Joint Railway

COLOUR-LIGHT SIGNALLING ON THE CHINGFORD BRANCH, L.N.E.R.

An interesting example of colour-light signalling applied to a suburban line including busy level crossings

COLOUR-LIGHT signalling has now been brought into service on the 6 miles between Clapton junction and Chingford, L.N.E.R., to link up with the Bethnal Green—Clapton section, the re-signalling of which was described in our issue for February 21, 1936, page 333. This branch carries, at the busiest periods, only one class of traffic, but the signalling is complicated by the presence of some much used sidings controlled by ground frames, and some busy highway crossings. Between 6 a.m. and midnight there are 130 regular passenger trains in each direction, and the average rush period headway is 4 min.

Signals

The general layout of the signalling is illustrated in the accompanying diagram. In view of the uniformity of train schedules, 3-aspect searchlight signals are used throughout. Where platform canopies render the sighting of starting signals difficult, internally illuminated banner repeaters have been installed. At Clapton junction, where the Cambridge main line diverges, splitting signals are employed, but at the remotely controlled points at Hall Farm junction the up junction signal carries a position-light junction indicator, of the type installed on the Waterloo-Hampton Court section of the Southern Railway. Controlled signals are operated by mechanically interlocked levers in the signal boxes concerned.

Signal Locations

Only seven signals are purely automatic. Of the remainder nine operate normally as automatics but become controlled when it is desired to use the ground frame layouts they protect, and six are semi-automatic. There are two classes of ground frame, namely, location freight sidings such as Walthamstow U.D.C. siding (Wood Street), for operation by train crews, and those such as Hoe Street, A and B, and Chingford goods yard, operated as required by a porter-signalman or other staff than the train crews. The former have a short track circuit extending from the signal for about 200 yd. beyond the points controlled by the ground frame. A freight train setting down or picking up traffic first stops at the signal, and is then divided. The front portion draws just clear of the points leaving the rear portion on the berth track, thus keeping the signal in the rear at danger. The point lever, locked until the berth and short overlap tracks are occupied, is then free, and shunting operations can begin, but a whole train cannot enter the siding and be shut in.

Level Crossings

At the level crossings a ground frame is arranged for operation by the gateman, as at Chingford Hatch level crossing, where there are two control levers, for controlling the up and down signals next in rear respectively. The gate locking gear is mechanically interlocked with them and cannot be operated until both are fully normal. They are controlled by electric locks in the "normal indication" position, and have circuit controllers for the various signal controls. To open the gates to road traffic, the gateman must have these levers normal. Signals DC9 and UC10 go to "danger" as soon as the levers are moved from the full reversed position, but whether the latter can be restored fully normal depends upon the occupancy of the track circuits in rear of the crossing on the up and down lines. If, for example, track circuits 67, 69, 71, 73 are all unoccupied, the indication lock on the down line control lever can be energised, the lever be put to normal, and the gate-lock lever partly released, but if any of them are occupied a time-element relay prevents the release being obtained until a predetermined interval has elapsed, fixed to give ample time for an approaching train to come to a stand or clear the crossing.

In the ordinary way the gateman would not attempt to open the crossing with either of the track circuits 71 and 73 occupied. The condition of these track circuits, and of the corresponding two on the up line, is shown by means of illuminated indicators mounted adjacent to the ground frame, with two others to repeat the signals controlled by it. This method of signal control is also employed at ground frames controlling sidings at Hoe Street and Highams Park. Hoe Street B ground frame has, however, only one lever controlling up and down signals. At Chingford Hatch there is no control upon the lever operating the wicket locks as, owing to the number of pedestrians using the crossing, it was thought desirable to leave these gates free till the last moment, their locking being left to the discretion of the gateman. The first notification of the approach of a train is by bell signal from either Chingford signal box or Highams Park station.

Signal Lamp Proving

The proving arrangements differ from those on the Bethnal Green—Clapton section, where if a signal lamp fails the signal in rear is held "on." On the Chingford line the signals have special double-filament lamps with the more powerful filament slightly out of focus with the optical system and normally extinguished. Should the main, or focus, filament fail, the second is automatically switched in and, owing to its greater power, there is little diminution in the signal beam. There are selective telephones at all signals, and we understand that this line and the area described in our previous article are to have "P" signs, the latest recommended practice of the Ministry of Transport.

Signal Boxes

Clapton junction and Chingford signal boxes are always open, but Wood Street box, where a number of trains used to terminate, is switched in only when required. Lock-and-block remains between Clapton junction and Copper Mill junction, where the Cambridge line joins the older route northward from Stratford, but in the case of north-bound trains taking the spur from the Chingford direction to the Cambridge line connection between the two boxes concerned is by slotting. The points controlling such a movement are electrically operated from Clapton junction and the directional signal is released from this box also; it is not cleared, however, until the Copper Mill signalman pulls his lever. The southern spur from Chingford to the Stratford line remains controlled by lock-and-block between Clapton junction, whence the points are operated, and Lea Bridge junction.

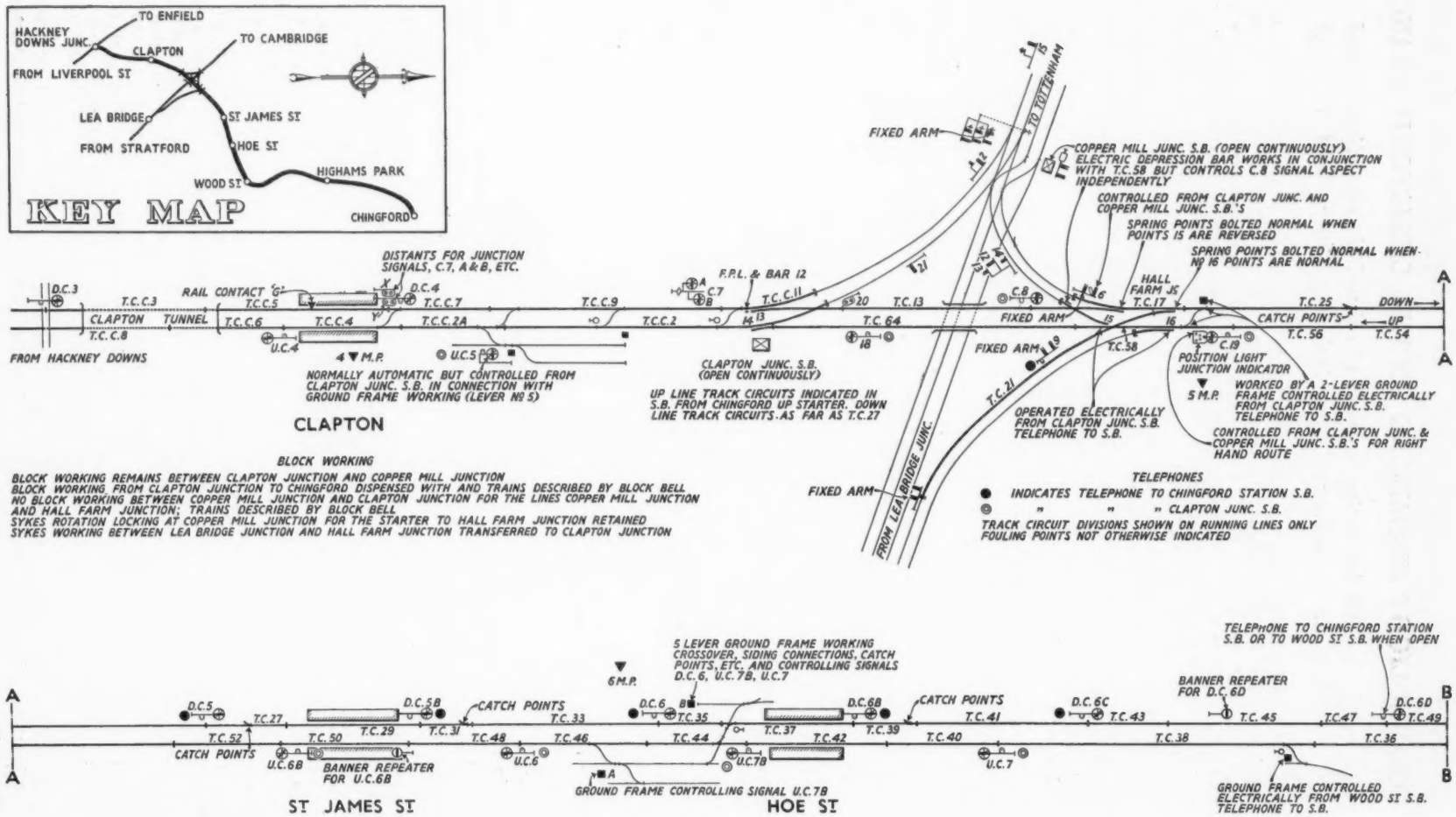
Signal Box Equipment

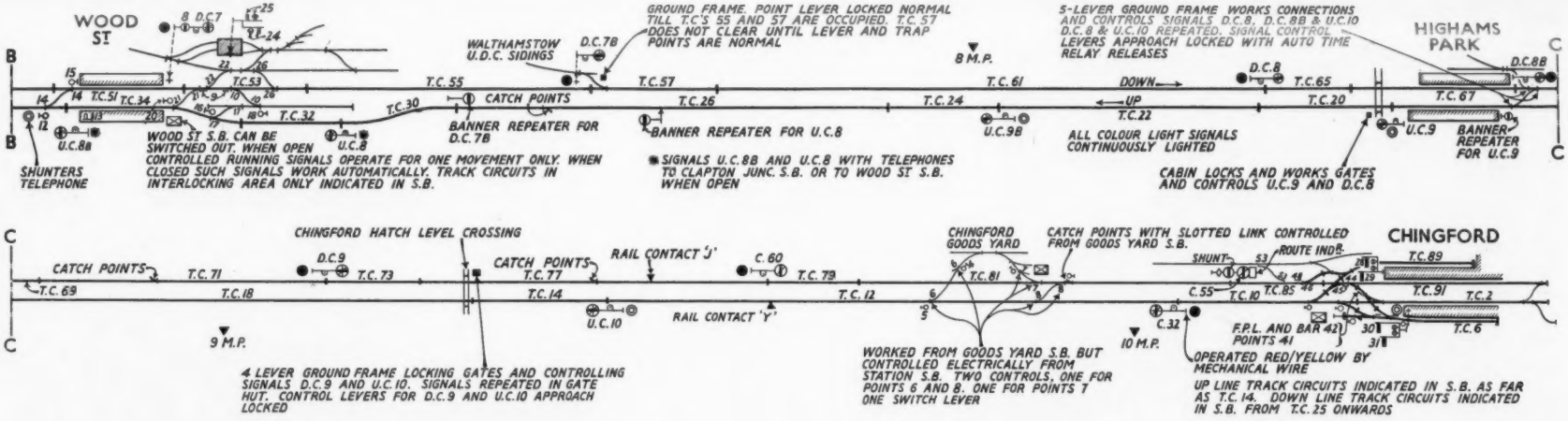
The mechanical locking frames at Clapton junction, Wood Street, and Chingford were re-locked. Combined

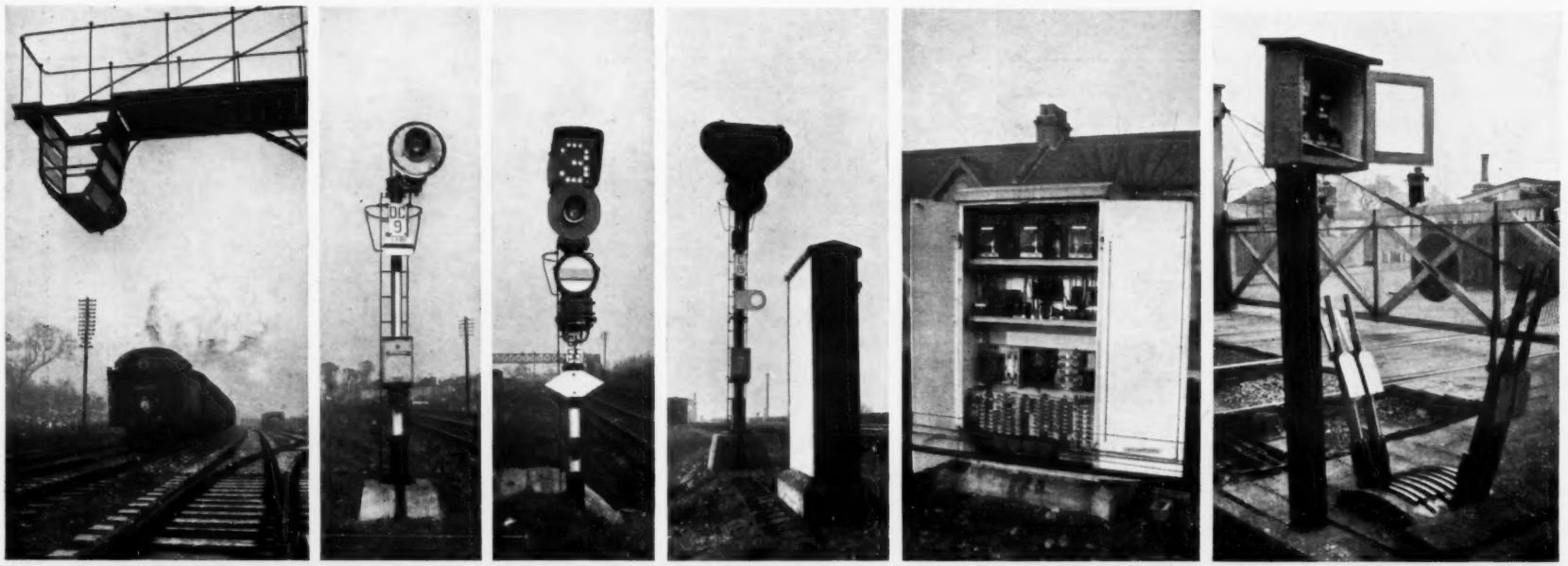
XUM

Colour-light Signalling on the Chingford Branch, L.N.E.R.

General line diagram showing arrangement of signals, track circuits, &c.




WOOD ST
8 D.C.7
T.C.53
T.C.51
T.C.34
T.C.32
T.C.30
U.C.8a
U.C.8
SHUNTERS TELEPHONE
WOOD ST S.B. CAN BE SWITCHED OUT. WHEN OPEN CONTROLLED RUNNING SIGNALS OPERATE FOR ONE MOVEMENT ONLY. WHEN CLOSED SUCH SIGNALS WORK AUTOMATICALLY. TRACK CIRCUITS IN INTERLOCKING AREA ONLY INDICATED IN S.B.
WALTHAMSTOW U.D.C. SIDINGS
D.C.7B
T.C.55
T.C.57
CATCH POINTS
BANNER REPEATER FOR D.C.7B
GROUND FRAME. POINT LEVER LOCKED NORMAL TILL T.C'S 55 AND 57 ARE OCCUPIED. T.C. 57 DOES NOT CLEAR UNTIL LEVER AND TRAP POINTS ARE NORMAL
T.C.26
BANNER REPEATER FOR U.C.8
SIGNALS U.C.8B AND U.C.8 WITH TELEPHONES TO CLAPTON JUNC. S.B. OR TO WOOD ST. S.B. WHEN OPEN
8 M.P.
T.C.61
T.C.24
U.C.9B
5-LEVER GROUND FRAME WORKS CONNECTIONS AND CONTROLS SIGNALS D.C.8, D.C.8B & U.C.10 D.C.8 & U.C.10 REPEATED. SIGNAL CONTROL LEVERS APPROACH LOCKED WITH AUTO TIME RELAY RELEASES
DOWN
UP
T.C.22
ALL COLOUR LIGHT SIGNALS CONTINUOUSLY LIGHTED
D.C.8
T.C.65
T.C.20
HIGHAMS PARK
D.C.8B
T.C.67
U.C.9
BANNER REPEATER FOR U.C.9
CABIN LOCKS AND WORKS GATES AND CONTROLS U.C.9 AND D.C.8
CHINGFORD HATCH LEVEL CROSSING
CATCH POINTS
T.C.71
T.C.69
T.C.18
D.C.9
T.C.73
CATCH POINTS
T.C.77
T.C.14
RAIL CONTACT 'J'
C.60
RAIL CONTACT 'Y'
U.C.10
T.C.79
T.C.12
9 M.P.
4 LEVER GROUND FRAME LOCKING GATES AND CONTROLLING SIGNALS D.C.9 AND U.C.10. SIGNALS REPEATED IN GATE HUT. CONTROL LEVERS FOR D.C.9 AND U.C.10 APPROACH LOCKED
CHINGFORD GOODS YARD
T.C.81
CATCH POINTS WITH SLOTTED LINK CONTROLLED FROM GOODS YARD S.B.
WORKED FROM GOODS YARD S.B. BUT CONTROLLED ELECTRICALLY FROM STATION S.B. TWO CONTROLS, ONE FOR POINTS 6 AND 8, ONE FOR POINTS 7 ONE SWITCH LEVER
C.32
10 M.P.
CHINGFORD
SHUNT
ROUTE IND.
T.C.89
T.C.85
T.C.10
C.55
T.C.91
T.C.2
T.C.6
F.P.L. AND BAR 42 POINTS 41
OPERATED RED/YELLOW BY MECHANICAL WIRE
UP LINE TRACK CIRCUITS INDICATED IN S.B. AS FAR AS T.C. 14. DOWN LINE TRACK CIRCUITS INDICATED IN S.B. FROM T.C. 25 ONWARDS

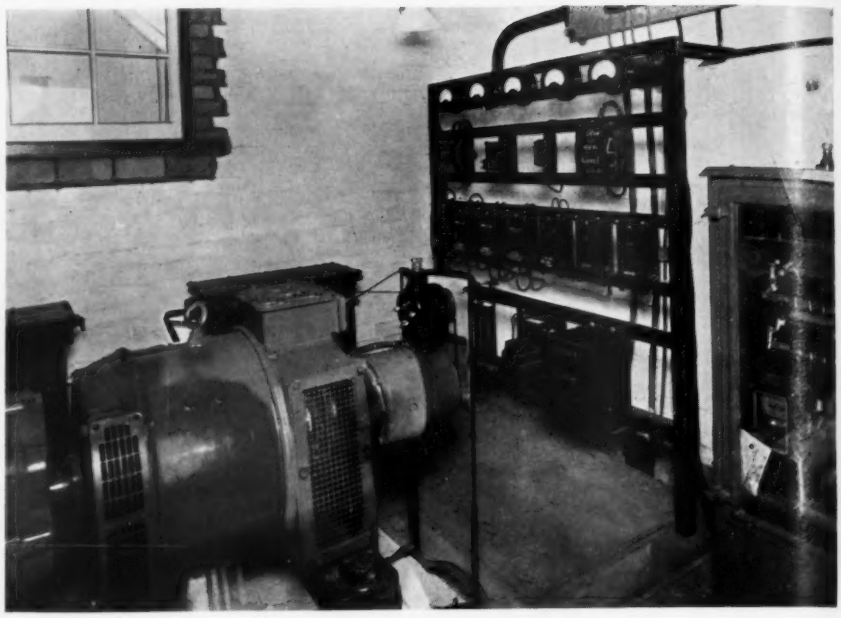


(1) *Clapton junction up starting signal showing special suspended fitting on bracket post.* (2) *Semi-automatic signal, DC 9, on the approach to Chingford Hatch level crossing.* (3) *Chingford station down home signal with multiple lamp route indicator and banner shunt signal. The route indicator shows also towards the station for the information of the staff.* (4) *Hall Farm junction signal C 19 with 2-way position light.* (5) *Apparatus case at an automatic signal location.* (6) *Ground frame at Chingford Hatch level crossing, with indicators in box on post*

electric lever locks and circuit controllers now provide the various layouts with all the protection of a power interlocking. Signalling at the two ends of the line is carried on with the aid of illuminated diagrams and, as the signalling plan shows, care has been taken to give signalmen the fullest possible information about traffic movements, the Chingford diagram covering the route practically to Hall Farm junction, and the Clapton diagram extending to beyond Chingford Hatch crossing.

Track Circuits and Cables

Track circuits are of the a.c. reactance feed type, with resonated relays, which, with the feed equipment, are housed in commodious all-welded location cases. Such track circuits have the special advantage of being pre-adjustable; any variation in ballast leakage can be automatically compensated in the track feed. Single wire armoured lead-sheathed paper-insulated cable is used for all outside cable runs, brought direct into the location cases to special sealing potheads, and obviating the use of separate cable disconnection boxes in all but a few isolated instances.



Interior of power house at Wood Street

Power Supply

Current is supplied from a transformer station at Wood Street where the main supply is taken at 400 volts from the Walthamstow Borough Council, and stepped up to 660 volts, 2-phase, one phase supplying the section north of Wood Street, the other the section southward. The stand-by supply is provided by a petrol alternator set, automatically cut in should the main supply fail. An interesting feature is a tubular electric heater alongside the petrol engine, controlled by a thermostat to keep the room at the correct temperature for instant starting of the stand-by set.

The changeover was carried out on two successive week-ends, and the complete installation was handed over to the Traffic Department on Sunday, January 30. The most difficult part of this work lay in the signal boxes, where considerable alterations to locking had to be made. No little ingenuity was shown in accommodating the signalling relays, space being very confined, but workmanlike cabinets were got in which provide very easy access to all apparatus. The installation affords an excellent example of how improved traffic facilities can be provided with comparatively simple equipment and simple circuits when circumstances do not warrant all-power interlocking.

The complete signalling scheme was prepared to the requirements of Colonel H. H. Mauldin, Superintendent, Southern Area (Eastern Section), L.N.E.R., under the direction of Mr. R. J. M. Inglis, Engineer, by Mr. A. E. Tattersall, Signal and Telegraph Engineer, Southern Area. The equipment was supplied and installed by the Westinghouse Brake & Signal Co. Ltd., to whom the Craigpark Electric Cable Co. Ltd., was the sub-contractor for all cables. Platform repeater signals were made for the contractors by W. R. Sykes Interlocking Signal Co. Ltd.

Power-operated facing points at Hall Farm Junction

Note rodding, from far side of point operating stretcher rod, leading to adjacent trailing layout. The trailing points are held by spring in the position shown, though free to be trailed on account of the slotted connection from the point machine. When the motor-worked facing points are reversed, the trailing points are also pulled over against the spring

NEW LONDON INFORMATION BUREAU—The Travel & Industrial Development Association's information bureau at 29, Cockspur Street was opened to the public on Tuesday, April 12. The venture was given a send off the previous evening by the Earl of Derby, President of the Association.

REPLACING WOODEN BY STEEL COACH BODIES IN FRANCE

Test collisions demonstrate effectiveness of economical strengthening

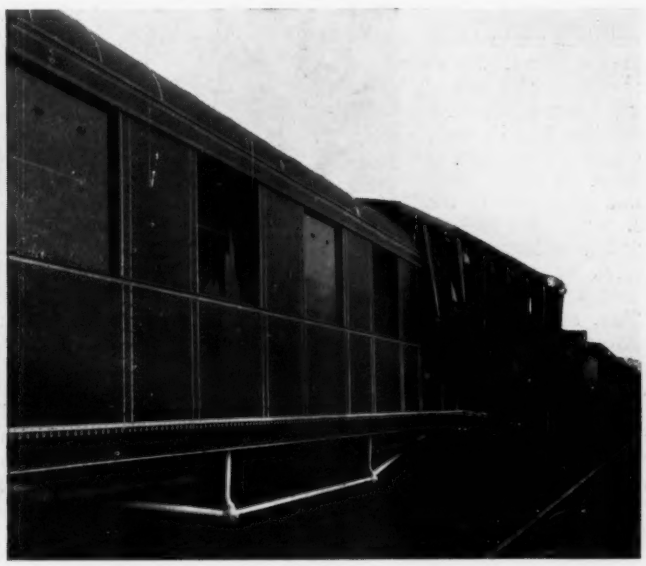
Steel coach practically undamaged and wooden-bodied coach wrecked in test collision at 26 m.p.h.

MONSIEUR BERTRAND, Chief of the Rolling Stock Section, French National Railways, describes in the February issue of the *Revue Générale des Chemins de fer* steps taken to accelerate the abolition of wooden bodied coaches by providing them with new steel bodies, designed for substitution with the minimum interference with the remaining parts of the vehicle. The problem was how to do this within a cost of fr. 100,000 (about £630) and without increase in weight. The design was ready in June, 1937, and by November a specimen bogie corridor coach was completed, with which special test collisions were conducted in December.

The interior of the coach, unaltered as regards partitions, floor, compartment fittings, steam heating, and so on, receives a new shell of steel formed to exact size on jigs so that the work may be done rapidly and accurately on a quantity basis. The elements of the shell are the two framed and sheeted sides which are riveted to the underframe; the roof, riveted and welded to the sides; and the ends, which contain the vestibules, and are specially strengthened to resist telescoping. The only doors are in the end vestibules, and the steel-framed body shell thus becomes, with the steel underframe, a tubular girder of great strength. The conversion was effected without increasing the weight of the coach.

The converted coach was tested on the Rochefort—Aigrefeuille line, normally used only for goods traffic. At the foot of a 1 in 200 gradient a train weighing 150 *tonnes* was stationed, composed of a locomotive and tender with brakes applied, and the test coach placed between two 4-wheeled semi-steel coaches, *i.e.*, having a steel underframe carrying a wooden body with steel

Wooden-bodied coach completely telescoped in test collision at 29 m.p.h.



Wooden-bodied coach driven over end of steel coach in 29 m.p.h. test collision

panelling up to the underside of the windows. A buffer stop of sleepers was placed in front of the locomotive. To invite telescoping the track was raised 10 cm. ($3\frac{7}{8}$ in.) immediately behind the test vehicle, which, in the first experiment, had not been strengthened.

The colliding train, weighing 116 *tonnes*, consisted of a dead locomotive and tender and two coaches, started down the incline by a pusher engine; it struck the stationary train at 41·7 km.p.h. (25·9 m.p.h.), driving the rear vehicle through the wooden body of the bogie test coach which was of the ordinary pattern in the first experiment.

In the second experiment the strengthened coach was used. The four-wheeled vehicle behind it split and was driven round its ends, but the only damage to the test coach was a broken window, only the end of the body being damaged.

The weight of the colliding train was raised to 210 *tonnes*, its speed to 45 km.p.h. (28·9 m.p.h.) and the difference in track level to 13 cm. ($5\frac{1}{8}$ in.), giving an effective buffer level difference of 18 cm. ($7\frac{1}{8}$ in.). Under these conditions the body of the ordinary wooden bogie coach was completely destroyed by the semi-steel vehicle behind, and the end of the vehicle ahead was also smashed. The converted coach was then similarly tested and suffered only superficial damage, although the semi-steel four-wheeler into which the colliding engine charged was driven over it and destroyed.

MACHINING LOCOMOTIVE PISTON VALVE LINERS

Combination turret lathe used at the Swindon works of the Great Western Railway

THE photograph reproduced* shows a portion of a combination turret lathe supplied by H. W. Ward & Co. Ltd., of Birmingham, to the Swindon locomotive works of the Great Western Railway. It is used there for machining 8-in., 9-in., and 10-in., cast iron piston valve liners. In this work, three operations are involved, the liner being gripped in a three-jaw concentric chuck with special jaws, and completed at one chucking.

Machining piston valve liners in Swindon works

In the first operation, the liner is faced to length, and in the second, it is rough bored and turned simultaneously. The boring bar has two heads with one cutting tool in each. One head is placed ahead of the other, equal to half the length of the bore, and the tool is carried in a hinged box operated by means of a rod and cam. The leading tool is inserted half-way in the liner, and the required depth of cut put on, and by this means the bore is roughed out in two stages requiring only half the turret travel.

A knee turning tool holder is used in conjunction with the boring bar, which rough turns a portion of the outside of the liner, the remainder being completed by the tool in the square holder on the cross slide. The third and final operation is the parting off, in which a special disc steady is used to steady the liner and to catch it when parted off.

The Ward No. 10 combination turret lathe, with patent covered bed, has been designed to afford the high speed and heavy cutting which tungsten carbide and modern alloy cutting tools will allow. The headstock is of the single-pulley all-geared type, giving 16 spindle speeds forward and reverse. All gear shafts and the spindle are carried on ball and roller bearings, and all gears are of high quality heat-treated steel, with profile-ground teeth. The intermediate saddle has automatic sliding, surfacing and screwcutting motions, so arranged that it is impossible to use the screw-cutting motion when other feeds are engaged. The turret saddle is of heavy construction, and slides directly on the bed. A travel of 54 in. per min. is obtained, and there are 10 rates of automatic feed. The bed shears are always protected by means of heavy channel sections of rustless steel.

* By courtesy of Mr. C. B. Collett, Chief Mechanical Engineer, Great Western Railway

THIRTY YEARS OF RACK WORKING ON THE BENGUELA RAILWAY

Notes on the history of the railway as a whole, and a description of the rack section and its locomotives, their operation and maintenance in particular

THE Benguela Railway (Caminho de Ferro de Benguela), in the Portuguese colony of Angola, runs from Liobito, on the West Coast of Africa, eastwards to the Congo frontier, a distance of about 840 miles (1,350 km.). It provides the shortest route between Europe and the great copper fields of Katanga and Northern Rhodesia. The only alternative ports of any importance for this traffic are Matadi and Beira. Matadi, near the mouth of the Congo, is accessible only by a combined rail and river route, entailing transhipment between train and steamer. Beira, which is on the East Coast, is 7,576 miles from Southampton, against 4,889 to Lobito.

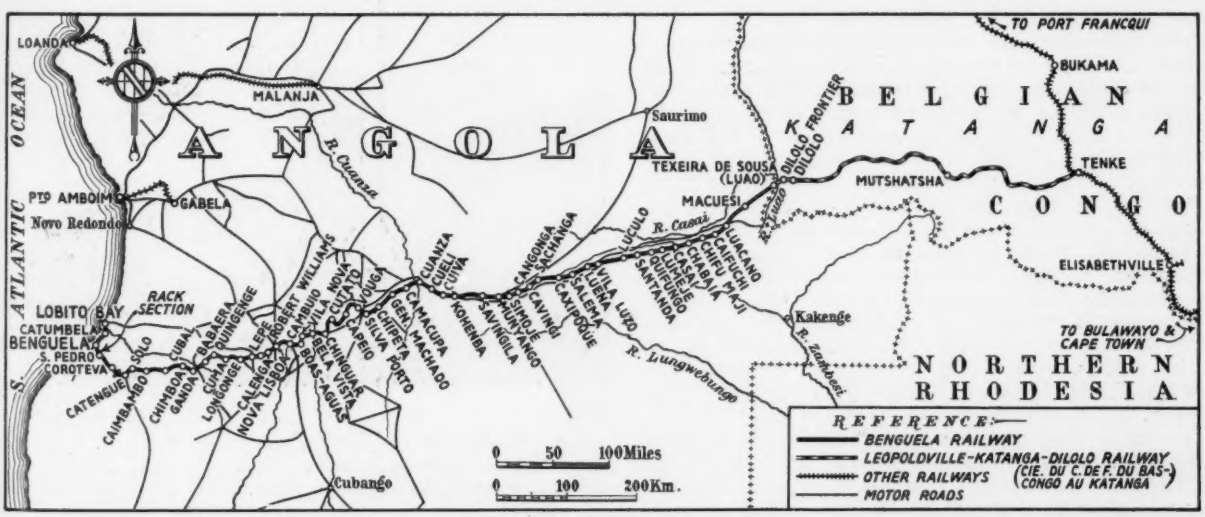
Beginning of the rack with Eduardo Costo viaduct in background

Construction of the Benguela Railway began at Lobito in 1904, and the first section, Lobito—Benguela—Cubal, 122 miles (197 km.), was opened for traffic in 1908. By 1913 the line had reached Chinguar, 324 miles (519 km.). Further extension was stopped by the war, and work was not resumed until 1920. At first progress was slow, Silvo Porto, 392 miles (km. 627), not being reached until January, 1924. At last, in December, 1928, the railway crossed the Luao River, which since 1927 has defined the frontier between Portuguese Angola and Belgian Congo.

The route was then extended eastwards, by the Compagnie du Chemin de Fer du Bas-Congo au Katanga, to Tenke, where it connects with the network of railways through the Congo, Northern and Southern Rhodesia, the Union of South Africa, Portuguese East Africa, and Nyasaland. In common with all these railways the Benguela Railway is built to the standard South African gauge of 3 ft. 6 in. (1·067 m.), so that through running is practicable from Lobito to Beira, Lourenço Marques, Durban, Johannesburg, and Cape Town.

The Rack Section

On the Benguela Railway there is one rack section, about 1⅓ miles (2·135 km.) in length. It has been in uninterrupted service for nearly 30 years and is today using the original rack locomotives, and, except for a few replacements, the original rack. The rack incline occurs in the first section of the railway, opened in 1908. It begins near Lengue (31 miles or 50 km.), where the railway, after leaving the coastal plain at Benguela (22½



Sketch map showing the route of the Benguela Railway and indicating the position of the rack section. The L.K.D. Railway, which continues the line through the Belgian Congo to Tenke, is worked by the Cie. du c. de f. du Bas-Congo au Katanga

Rack locomotive built by the Maschinenfabrik Esslingen

miles or 36 km.) enters mountainous country and begins the long climb up to the inland plateau. For rather more than half its length the route of the rack is on curves, of which there are eleven in all, with a minimum radius of 7½ ch. (150 m.). The gradient ranges from a minimum of 4·4 per cent. (1 in 23) to a maximum of 6·06 per cent. (1 in 16½). Allowing for curvature the maximum effective gradient is 6·42 per cent. (1 in 15½).

The rack section crosses the Lengue Gorge twice. The first crossing occurs at the lower end of the rack where the line is carried over it by the Eduardo Costa viaduct consisting of five deck spans with a total length of 308 ft. (93·47 m.). The viaduct is on a gradient of 1 in 21, and for half its length on a curve of 7½ chains (150 m.) radius. The other crossing, Viaducto Aires de Ornelas, about ¼-mile (400 m.) further from the lower end of the rack, is straight and comprises one arch span of 138 ft. (42 m.), and several short approach spans. Except on the viaducts the rack section is stone-ballasted throughout.

The rack is of the Riggenbach, or ladder type, and the individual bars are 10 ft. (3 m.) long. Each bar comprises two side channels with connecting rungs of trapezoidal section. At each end of the rack the last rung is spring suspended so as to facilitate engagement of the rack wheel.

Rack Maintenance

From the outset the rack section has worked satisfactorily and has been entirely free from accidents. Wear and tear have also been remarkably small. At long intervals a few of the rungs have had to be replaced, usually on account of faulty engagement of the locomotive rack wheel at the entry of the rack. Occasionally also rungs in other parts of the rack have received slight damage, which is readily understandable in view of the long period of service and the high stresses to which they are subjected. On curves there has been a certain amount of wear of the inner running rail, and for this reason 220 yd. (200 m.) of rail were replaced in 1935, the gauge at the same time being slightly narrowed. The continued good working of the rack after nearly 30 years of service reflects great credit not only on the suppliers, Maschinenfabrik Esslingen, of Esslingen, Germany, but also on the staff of the railway, whose members have always given close attention to the rack and have taken every precaution to foresee and forestall interruptions. It has been their practice to lubricate the rungs regularly with a mixture of 25 per cent. soft soap and 75 per cent. mineral lubricating oil.

Traffic over the rack is worked by four 0-6-2 saturated steam compound tank locomotives with Walschaerts valve gear. The weight of each locomotive in running order is 45·3 tons, of which 36 tons are available for adhesion. The boilers have a heating surface of 1,027 sq. ft. (95·4 sq. m.) and a grate area of 20 sq. ft. (1·86 sq. m.). The working pressure is 200 lb. (14 atm.) per sq. in. Each locomotive carries one ton of coal and 672 gallons of water. There are four cylinders, 17⅛ in. (435 mm.) dia. by 18⅞ in. (480 mm.) stroke, arranged in pairs one above the other outside the frame. The two lower (h.p.) cylinders drive the six adhesion wheels, which have a diameter of 3 ft. 4 in. (1,016 mm.) while the two upper (l.p.) cylinders, in which the pistons travel at 2·56 times the speed of the h.p. pistons, drive the rack wheel through gearing. There are brake blocks on the six coupled wheels, operated by vacuum or by hand screw, and in addition a grooved band brake on the first-motion shaft of the rack wheel gear, and a similar brake on a second rack wheel, which runs loose on the leading coupled axle. Further, the locomotive has a counter-pressure brake of the Riggenbach type and vacuum brake gear for operating the train brakes.

On both the up and the down journeys the rack locomotive is coupled to the downhill end of the train. Each rack locomotive by itself can deal with a train of 160 tons, but somewhat heavier trains may be pushed up the incline by using an additional locomotive. The speed is from 7 to 10 miles (11-15 km.) p.h.

We are indebted to the Benguela Railway Company and to its Consulting Engineers, Sir Douglas Fox & Partners, for placing at our disposal the particulars and records of the railway and the photographs we reproduce.

A Modern Single-Switch Point

Photo] *[L. T. Catchpole*

Single-switch point at Summit station on the 3 ft. 6 in. gauge Snaefell Mountain Railway, Isle of Man. The cars use this crossing only after passengers have been unloaded. This switch is an interesting example of the early mineral railway practice exemplified by the sixteenth century exhibit in the Verkehrs-und Baumuseum, Berlin, illustrated in our February 11 issue

RAILWAY NEWS SECTION

PERSONAL

Mr. P. A. Clews, European Manager, and Mr. George E. Cowie, General Freight Agent, Canadian National Railways, have been respectively appointed second Vice-President, and Honorary Treasurer of the Canadian Chamber of Commerce in Great Britain.

Mr. S. J. Hungerford, Chairman and President of the Canadian National Railways, has been elected an Honorary Member of the Scientific Institute of Studies of Communications and Transport, Paris. His election is stated to be "especially on account of the great services which he has rendered to the general progress of railways."

Mr. H. B. Pollock, Director of the Great Southern Railways, Eire, has been re-elected Governor of the Bank of Ireland for the ensuing year.

Major Hugh A. Henry, Deputy Chairman of the Great Southern Railways, has been re-elected Deputy Governor of the Bank of Ireland for the ensuing year.

RAILWAYMEN ON EIRE SENATE

Two members and two former members of the staff of the Great Southern Railways have been elected members of the new Senate in Eire:—

Mr. John Newcome, Draughtsman in the District Engineer's Office, Westland Row.

Mr. John Gaffney, Driver, of Ballinamore, Co. Leitrim, working on the Cavan & Leitrim section of the railway.

Mr. Hughes, formerly a Shunter at North Wall, Dublin.

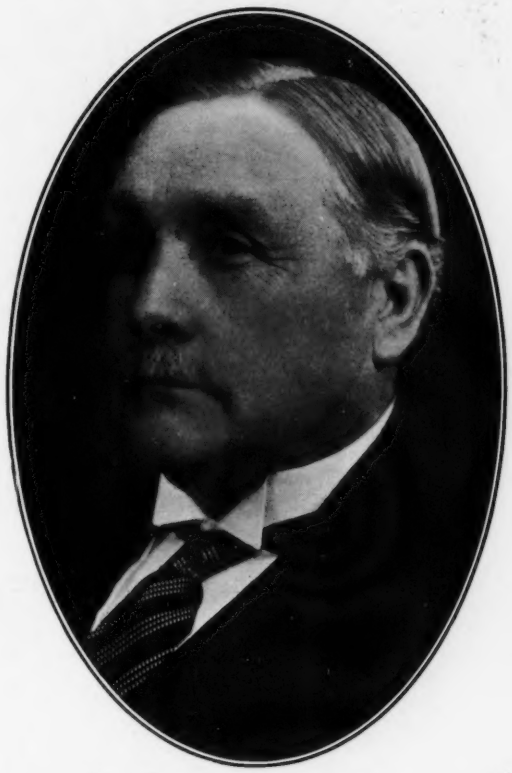
Mr. Tunney, also formerly employed at North Wall.

The late Sir John Noble, a Director of the L.N.E.R., who died on January 8, left estate valued at £583,167 (£398,744 net.)

Mr. L. F. Loree, President of the Delaware & Hudson Railroad since 1907, has resigned. Mr. Loree is nearly 80 years of age.

Mr. J. S. Pyeatt, President of the Denver & Rio Grande Western Railroad, has been elected Chairman of the Missouri Pacific Railroad, and of two of its subsidiaries—the International Great Northern Railroad, and the New Orleans, Texas & Mexico Railway. Mr. Pyeatt succeeds Mr. G. A. Tomlinson, who has resigned.

It is with regret that we record the death on April 25 at the age of 78 of Sir Robert Williams, Bt., the famous Central-African pioneer and associate of Cecil Rhodes. Robert Williams was born in Aberdeen on January 21, 1860. He studied civil—particularly mining—engineering and went to South Africa at the age of 21 to seek his fortune at the Kimberley diamond mines. His meeting with Cecil Rhodes developed into a lifelong friendship, and Williams's part in furthering the great developments and transport schemes of Rhodes was to help the northward extension of the Cape-to-Cairo Railway by endeavouring to locate minerals on the route. Setting out from Vryburg, the then railhead, in March, 1891, he covered large areas of what is now Southern Rhodesia, and it was these activities which justified the northward extension of the railway and also the building of a line from Bulawayo to the Portuguese East African port of Beira. Perhaps his greatest railway work, however, was the formation of the Benguela Railway linking Rhodesia with the Portuguese West African coast. Sir Robert was created a Baronet in 1928 and both Belgium and Portugal also honoured him. In 1929 he was present at the formal opening of the Benguela Railway to the Belgian Congo border, and in March, 1931, the through road from Lobito Bay to the main railway from Cape Town was completed. At the time of his death Sir Robert was head of the mining-engineering firm of Sir Robert Williams & Company; Managing Director of Tanganyika Concessions Limited, the Rhodesia-Katanga Co. Ltd., and the Zambesia Exploring Co. Ltd.; Chairman of the African Railway Finance Co. Ltd., Kentan Gold Areas Limited, and the Kimingini Gold Mining Co. Ltd.; Vice-President of the Cie. du Chemin de fer du Katanga, and the Union Minière du Haut Katanga; and a Director and Member of the London committee of the Cia do Caminho de Ferro de Benguela. In an editorial note on page 821 we refer to some aspects of Sir Robert's railway work, and a short article on pages 841-2 describes 30 years of working on the rock section of the Benguela Railway which is one of his great monuments. The funeral took place at Drumoak on Thursday, and a memorial service was held at Holy Trinity, Brompton, on the same day.



The late Sir Robert Williams, Bt.

Chairman, African Railway Finance Co. Ltd., Vice-President, Katanga Railway; and Director, Benguela Railway

---

We regret to record the death, during March, of one of the greatest authorities on bridge engineering of our time, John Alexander Low Waddell; he was in his 85th year. His career was devoted solely to the design and construction of bridges, and among the many large ones that he built in the United States were those spanning the Mississippi at Cairo and the Colorado River at the Needles. He was also responsible for the design of the modern type of vertical lift bridge. Dr. Waddell was Consulting Engineer to the Chinese Ministry of Railways, and as a member of the international commission appointed to advise that Government, he was in close touch with the design of a proposed bridge over the Yellow River, about two miles in length. But to engineers in Great Britain, the Dominions, India, and the Colonies, Dr. Waddell is probably best known as the author of "Bridge Engineering," "De Pontibus," "Economics of Bridgework" and other standard works on bridge design and construction. He was born in Ontario in 1854 and graduated at the Rensselaer Polytechnic Institute in 1875, where he was also subsequently an instructor;

XUM

he received a railway engineering training. In 1881 he became Chief Engineer to a bridge-building firm, but went to Japan a year later as Professor of Civil Engineering at Tokyo University. In 1886 Dr. Waddell returned to the U.S.A. and founded the firm of consulting engineers with which his name was associated alone or with different partners throughout the subsequent 52 years until his death. As a monument to his memory the largest roadway lift span bridge was recently completed for carrying the Marine Parkway over Rockaway Inlet, New York City; the bridge is nearly 4,000 ft. in total length, and has three central spans each of 540 ft., the middle one being the lift span. Messrs. Waddell & Hardesty were the consulting engineers for construction of the bridge.

Mr. Charles Eustace Rooke, M.Inst.T., who, as recorded in our issue of June 18 last has been appointed Chief Traffic Superintendent of the Nigerian Railway, was born in 1892, and educated at Grange School, and Dover College. His first railway position was in the Goods Manager's Office, Holborn, of the former South Eastern & Chatham Joint Committee, which he joined in 1909. A year later he was appointed Timetable Clerk and Assistant Train Inspector, Argentine North-Eastern Railway. In 1912 Mr. Rooke joined the Bombay, Baroda & Central India Railway as Probationary Assistant Traffic Superintendent, and in 1914 was appointed Assistant Traffic Manager of the Uganda Railway. He joined the Indian Army in East Africa during the war, serving with it from 1915 until invalided in 1917. From 1919 to 1929 Mr. Rooke was Assistant Traffic Manager of the Federated Malay States Railways, and at the same period was Chairman of the Kinta Fuel Supply Board. He was appointed General Manager of the Cyprus Government Railway in 1929, retaining that post until 1935. While in Cyprus he was Acting Commissioner, Cyprus Civil Service, from June, 1934, until March, 1935; and a Member of the Trade Development Board and the Defence Committee. Mr. Rooke was appointed Traffic Manager of the Tanganyika Railways in 1935, and became Chairman of the Central Publicity Committee. He went to Nigeria last year as Chief Traffic Superintendent of the Nigerian Railway, his appointment dating from September 15, 1937. Mr. Rooke acts as General Manager of the railway in the latter's absence.

Mr. C. E. Rooke
Appointed Chief Traffic Superintendent, Nigerian Railway

At the annual meeting of the Federation of British Industries on April 6, Mr. Peter F. Bennett, O.B.E., J.P., was elected President of the federation for the coming year in succession to Lord Hirst. Mr. Bennett, who is Chairman and Managing Director of Joseph Lucas Limited, has long taken a leading part in the work of the federation, and during the past year he has been assisting the President, Lord Hirst, as Deputy President. He has also been for many years Chairman of the Birmingham District Committee of the federation. Mr. Bennett has been closely associated with the work of the federation's Empire Committee, and was himself present at the Ottawa Conference. He is a Past President of the Society of Motor Manufacturers & Traders.

Lt.-Colonel J. H. M. Greenly, C.B.E., has accepted the invitation of the Institute of Fuel to become President of the institute on October 13 next, succeeding Sir Philip Dawson. After being educated at Charterhouse and Trinity College, Oxford, where he took honours, Colonel Greenly was trained as a civil engineer with Messrs. Sir John Wolff Barry & Partners. He is Chairman of Babcock & Wilcox Limited; and is also a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research; Chairman of the British Non-Ferrous Metals Research Association; Chairman of the Coal Burning Appliance Joint Consultative Board; and Vice-President of the Combustion Appliance Makers' Association (Solid Fuel); besides being concerned with other technical and commercial bodies. Colonel Greenly has been a Vice-President of the Institute of Fuel for the past few years.

We regret to record the death on April 13 in Antwerp, after a long illness, of Mr. H. V. Gard, Passenger Agent of the Canadian Pacific at Ant-

Group at the annual dinner on April 23 of G.W.R. Companies of the R.E. Transportation Units, Supplementary Reserve. (*See page* 846)

Photo] [*Rawood*

werp since 1934. Mr. Gard, who was 41 years of age, entered the service of the Canadian Pacific at Liverpool in 1912. He saw service at Liverpool in 1912. He served in France and after hostilities was appointed Agent for the company at Kovno, and later represented the Canadian Pacific at Warsaw and Moscow. He returned to the London office, and in 1934 was made Passenger Agent at Antwerp. Mr. Gard's kindly and always cheerful personality had won him many friends, and his passing will be keenly felt.

His Excellency Dr. Sun Fo, formerly Chinese Minister of Railways and now President of the Legislative Yuan, is at present visiting this country, and on April 26 was entertained to luncheon at the Carlton Restaurant, London, by Mr. C. Peter Sandberg and Mr. O. F. A. Sandberg. There were also present:—

H.E. The Chinese Ambassador; Mr. S. Y. Wu, Chairman of the Economic Committee; Dr. C. L. Hsia, Member of the Legislative Yuan; Dr. C. C. Wang; Lord Riverdale; Brig.-Gen. Sir Harold Hartley; Sir Ralph Wedgwood; Sir Herbert Walker; Brig.-Gen. F. D. Hammond; Mr. Kenneth Cantlie; Mr. Gerald G. Fitzmaurice; Mr. N. E. F. Sandberg.

Letters of regret at inability to attend were received from Lord Ashfield, Lord Horne, Sir James Milne, Sir Josiah Stamp, and Mr. Gilbert S. Szlumper.

Mr. J. H. Dunn, Assistant, Railway Research Service, has accepted an appointment in the Traffic Department, Central Uruguay Railway, and sailed for Monte Video on April 23. Mr. Dunn began his railway career in the Divisional General Manager's office at York, L.N.E.R., in 1926, and, after considerable experience in other departments at Tyne Dock, King's Cross, Parkeston Quay, and elsewhere, was appointed to the Railway Research Service in April, 1936. He is a Graduate of the Institute of Transport, and a member of the Railway Students' Association.

INSTITUTION OF CIVIL ENGINEERS

The following elections were made at a meeting of the institution on April 5:

Member

Mr. J. H. Blackett, Dorada Railway, Colombia, South America.

Associate Member

Mr. E. H. Lovatt, B.Sc., Chief Engineer's Office, New Zealand Government Railways.

From *The London Gazette* of April 19: Territorial Army, Royal Engineers, Engineer and Railway Staff Corps: Major W. H. Bateman, M.C., M.Inst.C.E., from Territorial Army Reserve of Officers (43rd (Wessex) Divisional Engineers), to be Lt.-Colonel (April 20).

Señor Antonio Velao, who has charge of the portfolio of Public Works in the newly-formed cabinet of the Spanish Republican Government, is a civil engineer, and was Minister of Public Works before the outbreak of the civil war. Señor Velao was for several years Secretary to the Superior Railway Council. The Ministry of Communications and Transports in the new Government will continue under the charge of Señor Giner de los Rios.

Mr. J. H. McEwen, General Manager, Nigerian Railway, has arrived in London on short leave.

Brig.-General Sir G. D. Rhodes, C.B.E., D.S.O., General Manager, Kenya & Uganda Railways, has arrived in London on leave.

Mr. G. V. O. Bulkeley, C.B.E., Director of Transport, Government of Nigeria, who has been on a visit to London, is returning to Lagos on May 4.

The late Mr. Edwin Cottam, founder of Edwin Cottam & Co. Ltd., manufacturer of railway carriage and wagon springs, left personal estate valued at £81,611 (£79,627 net).

Mr. P. Ashley Cooper and Mr. John Cliff have been appointed members of the London Passenger Transport Board for a further period of five years from May 18, on the expiration of their present appointments. Before joining the board in 1933 Mr. Cliff was Assistant General Secretary of the Transport and General Workers' Union. Mr. Ashley Cooper also became a part-time member of the board in 1933. He is a Director of the Bank of England, and among other appointments holds the office of Governor of the Hudson's Bay Company.

TRAVEL CLUB LUNCHEON

Mr. C. Cooper, who retired from the position of Assistant to the Traffic Manager for Continental Traffic, Southern Railway, on March 31, was the guest on Tuesday last of a large gathering of the Travel Luncheon Club, at which the Chairman, Mr. W. Butterfield Hindle (Thos. Cook & Son Ltd.) presided. Speakers representative of the railway, shipping and tourist agencies testified to the admirable qualities displayed by Mr. Cooper during his long association with Continental travel, and the guest of honour suitably replied. Other guests on this occasion included Mr. G. V. O. Bulkeley, Director of Transport, Government of Nigeria, who gave an account of the possibilities of Nigeria as a tourist centre. At present it lacked hotel accommodation. Other speakers included Mr. P. de Malglaive; and Mr. White, Vice-President, Thos. Cook & Son, Inc., New York, who referred to the means of abating the unnecessary apprehension of American tourists in visiting Europe this year on account of the Continental situation.

BURMA RAILWAYS STAFF CHANGES

Mr. J. E. M. Rowland, Chief Railway Commissioner and President of Railway Board, has been granted six months' leave as from March 10.

Mr. G. G. T. Toller, Chief Engineer, has been appointed Chief Railway Commissioner and President of Railway Board as from the same date.

Mr. C. P. Brewitt, Deputy Railway Commissioner and Secretary, Railway Board, resumed duty on return from leave on February 28.

Mr. E. Procter, on relief by Mr. Brewitt, reverted to Statistical and Organisation Officer from that date.

Mr. J. M. G. Doog, Deputy Chief Engineer, has been appointed to officiate as Chief Engineer as from March 10.

Mr. C. B. Hayes, Superintendent of Stores, has been appointed to officiate as Deputy Chief Engineer, also as from the latter date.

Mr. N. Johnson, Officiating Locomotive and Carriage Superintendent, has been granted 5 months' leave as from March 11.

Mr. J. H. Cardew, Officiating Deputy Carriage and Wagon Superintendent, has been appointed to officiate as Locomotive and Carriage Superintendent.

Mr. J. A. Ferguson, District Locomotive Superintendent, has been appointed to officiate as Deputy Locomotive Superintendent, also as from March 11.

The late Mr. Thomas Rome, formerly Chairman of the Mersey Docks & Harbour Board and a Director of the Liverpool Overhead Railway, left estate of £26,658 (£24,911 net).

Mr. Walter W. Masser has retired from the position of Assistant to the Divisional General Manager, North Eastern Area, L.N.E.R., after 49 years with the company and the former North Eastern Railway. He acted as Assistant to the General Manager, N.E.R., when Sir Ralph Wedgwood held that position, and since then has been Assistant to four Divisional General Managers in the area. Mr. Masser was the guest at a complimentary luncheon on April 21, when he received presentations from the officers and from the Divisional General Manager's staff.

The following re-arrangements of the management staff of Southdown Motor Services Limited came into effect at the end of March:—

Mr. A. E. Cannon, hitherto a Director and General Manager of Southdown Motor Services Limited, has been appointed Managing Director.

Mr. A. D. Mackenzie, a Director for many years and formerly Traffic Manager of the company, becomes Executive Director.

Mr. A. H. Burman, Assistant Traffic Manager, succeeds Mr. Mackenzie as Traffic Manager.

Mr. A. F. R. Carling has been appointed Assistant Traffic Manager.

XUM

G.W.R. Units Royal Engineers' Supplementary Reserve

(See illustration on page 844)

The tenth annual dinner of the Great Western Railway Units of the Supplementary Reserve, Royal Engineers—Transportation, was held at the Chiltern Court Restaurant, London, on Saturday, April 23. Major E. C. Cookson, O.C. 152nd (G.W.) Railway Construction Co., R.E. (S.R.), presided and was supported by Major K. L. Yorath, O.C. 154th (G.W.) Railway Operating Co., R.E. (S.R.) and Major R. H. Edwards, O.C. 151st (G.W.) Railway Construction Co., R.E. (S.R.). About 200 present and past members of the units attended as well as a number of guests. Among those present were:—

The Hon. A. W. Baldwin (Director, G.W.R.); Major F. J. Biddulph, M.C., R.E. (R.T.C., Longmoor); Major A. Bond; Capt. P. D. G. Buchanan, R.E. (Adjt., S.R. Tptn. Units); Mr. A. C. Cookson; Mr. C. T. Cox; Major E. T. Davies, M.C.; Mr. K. C. Grand; Col. J. P. S. Greig (A.D.T., War Office); Capt. V. R. Illingworth, R.E. (S.R.); Mr. J. A. Kay (Editor, THE RAILWAY GAZETTE); Major R. C. Kirkpatrick; Mr. J. W. A. Kislingbury; Major C. A. Langley, M.C., R.E. (R.T.C., Longmoor); Lt.-Col. D. J. McMullen, O.B.E., D.S.O., R.E. (Commandant, R.T.C., Longmoor); Major A. S. Quartermaine, M.C. (Deputy Chief Engineer, G.W.R.); Capt. W. J. Scott, R.E. (S.R.); Mr. R. F. Thurtle; Col. W. G. Tyrrell, D.S.O. (late A.D.T.); Major S. E. Tyrwhitt; Lt.-Col. R. D. Waghorn, R.E. (R.T.C., Longmoor); Mr. A. Waple; Major H. S. B. Whitley; Mr. W. A. Willox (Associate Editor, THE RAILWAY GAZETTE).

Major Cookson, in proposing the toast of "The Great Western Railway," said that all members of the units belonged to both the G.W.R. and the Supplementary Reserve, and were proud of it. He was pleased to say that the strengths of the three companies were being well maintained. The Hon. A. W. Baldwin interspersed his reply with remarks of a humorous vein. After he had made reference to the recent Continental troubles he congratulated those present on the good work they were doing, and on being members of the Supplementary Reserve.

Major K. L. Yorath, in proposing the toast of "The Regular Army," said that it was gratifying to see that the Army was at last getting the support of the community, thanks to the publicity it was receiving from the press. He remarked on the importance of the Corps of Royal Engineers, as all branches had at some time or other to refer to the "Sapper." Col. J. P. S. Greig, responding, said that the British railways were the finest institution in the country. Since the formation of the Transportation Units a closer co-operation had developed between the War Office and the railways. The War Office was grateful for the support of the railway companies and their help in making a success of the Transportation Units.

Major A. S. Quartermaine proposed the toast of "The Supplementary Reserve" and referred to the absence of Colonel Carpmael, the Chief Engineer, who was unable to be present owing to illness. He said that the units had existed for over twelve years and the result was something of which to be proud. Considering that there had been practically no publicity for recruiting it was most creditable that the strengths had been so well maintained. Major R. H. Edwards, in responding, referred to the help they received, in connection with recruiting, from the railway officers and from the men themselves, who were the best recruiting agents. He said that he hoped the Secretary for War would authorise a badge to be worn by members of the S.R., when not in uniform, to indicate their membership, as was being done in the case of the Territorial Army.

In proposing the toast of "The Visitors," the Chairman apologised for the absence of a number of railway officers, and welcomed those present, especially those who had not been present on former occasions. He was especially pleased to welcome Colonel Tyrrell, who helped to create the Transportation Units, and who had since retired from the Army. Lt.-Col. D. J. McMullen, in responding, said that to keep out of war is to be prepared for one. He then gave some details regarding the proposed training programme to be carried out at the R.T.C. at Longmoor, this year.

After the toasts, the inter-company trophies were presented. The cups are for competition between the three G.W.R. Units, and in 1937 were won as follow:—

"Milne Cup" for general efficiency retained by the holders, the 154th Company.
"Lean Bowl" for selected sporting events, retained by the holders, the 152nd Company.
"Bowler Cup" for rifle shooting, won by the 151st Company.

Colonel J. P. S. Greig then presented a number of N.C.O.'s and men with efficiency medals which were awarded for 12 years' service.

A vote of thanks to the Chairman and his committee for the excellent arrangements for the dinner was proposed by Capt. W. J. Scott, R.E. (S.R.) and received with applause.

Mechanised Foundry at Dursley

R. A. Lister & Co. Ltd., the well-known engineering firm of Dursley, Gloucester, has added a mechanised foundry to its premises, and on April 22 organised a visit of inspection to see the works as a whole and their latest extension in operation.

The visitors were welcomed at the employees' club, Dursley, by Mr. Percy Lister, Chairman and Managing Director, and his colleagues—Messrs. R. B. Lister, G. A. Lister, A. C. Lister, F. H. Lister, and A. E. Mellerup. On the way to the new foundry, the visiting party inspected the engine erecting shop, where diesel engines ranging from 1½ to 40 h.p. are assembled by the most up-to-date methods; and the shop in which the firm's speciality—Lister Auto-trucks—are assembled. These vehicles are adaptable for all industrial purposes, or for passenger-carrying, and have been selected for the latter type of service at the Empire Exhibition, Glasgow.

The new foundry is 360 ft. long by 170 ft. wide, and 32 ft. high to the eaves. Raw material is delivered direct into the building by a siding of the L.M.S.R. which enters the foundry on one side; and by a roadway on the other. Within the foundry, wheeled skips running on a narrow-gauge railway liberally equipped with turntables and branches, convey material from every bin in the stores to the cupolas.

Two cupolas are at present in operation, but provision has been made for four if required. They are of the standard six-ton an hour type, with modified doors to allow either hand or machine charging. The foundry operates entirely with synthetic sand. Prepared sand is taken to the moulding machines on a flat belt conveyor. After casting, the moulding boxes containing the still hot castings and the sand travel on a platform conveyor to the knockout, where the sand is discharged through a grating and any tramp iron eliminated from it by magnetic means. It then automatically falls into a bucket conveyor for return, through a rotating screen, to the storage hopper. The castings are meanwhile loaded into containers for transport to the cleaning department, and the moulding boxes are attached to a pendulum conveyor for return to the nine compressed-air moulding machines.

In the equipment of this new foundry, the fullest advantage has been taken of the opportunity to install plant which can be relied upon to yield high-grade and easily machinable castings at the lowest cost per unit.

BEKONSCOT RESULTS IN 1937.—Visitors to Bekonscot, the miniature village and railway at Beaconsfield, Bucks, contributed total receipts of £2,427 during 1937. The slight decrease in attendance, from 57,095 to 56,012, was accounted for by the uncertain weather. The staff engaged in operation and maintenance has been increased to six persons, so that expenses were a little higher, but there still remained a balance of £1,217 10s., all of which was distributed to charities. The total distribution to charity since the village and railway were opened had reached £3,937 by the end of last year. The railway is working from 2 p.m. to 7 p.m. every Sunday and on the first Saturday in every month.

Ancillary Businesses of the British Railways in 1937

II—Hotels, refreshment rooms, and restaurant cars

Further expansion occurred in the catering business of the four group railways last year, and the gross receipts of £6,068,516 (the highest since 1929) were £245,041 greater than in 1936. On the other hand, there was an increase of £309,007 in expenditure, chiefly under the heads of commodity purchases, salaries and wages, and maintenance, with the result that the net profit was £63,966 less than that for the previous year. The following table shows the financial result achieved by each group:—

Company	Receipts		Expenditure		Surplus		Per Cent. of Surplus to Gross Receipts	
	1937	1936	1937	1936	1937	1936	1937	1936
	£	£	£	£	£	£		
G.W.R. ...	767,014	744,785	726,857	666,487	40,157	78,298	5·2	10·5
L.N.E.R. ...	2,073,970	1,953,549	1,908,511	1,789,403	165,459	164,146	8·0	8·4
L.M.S.R. ...	3,080,014	2,985,241	2,727,005	2,596,369	353,009	388,872	11·5	13·0
S.R. ...	147,518	139,900	130,083	131,190	17,435	8,710	11·8	6·2

It will be seen that the G.W.R. suffered a severe diminution in net profit last year, the figure of £40,157 being little more than half that recorded in 1936. Receipts increased by £22,229, but expenditure rose by £60,370, chiefly in respect of provisions, wines, and spirits, the cost of which was £37,645 in excess of the 1936 figure, while salaries and wages advanced by £15,675. Commenting upon this result at the annual general meeting, Lord Horne attributed the decreased profit, in part, "to generous alterations made in the bill of fare of the restaurant cars with the object of making the meals more attractive." These alterations included the introduction of *à la carte* breakfasts, 3s. 6d. dinners as an alternative to the 5s. meal, and various other improvements in the menus. It was a foregone conclusion that these concessions would result in a decreased percentage of profit, and it is obvious that the company has made a considerable sacrifice in its catering revenue in an endeavour to improve the restaurant car facilities. The improved menus have undoubtedly met with the approval of passengers, and it may well be that as the facilities become better known the business will increase sufficiently to enable better profits to be secured in future years.

There was an increase of £120,421 in the gross receipts of the L.N.E.R., but working expenses rose by £130,994, more than half of which was accounted for by increased expenditure on provisions, &c. There was an increase of £11,886 in the amount transferred from renewal or suspense account, however, with the result that the net profit of £165,459 was £1,313 greater than in 1936.

The L.M.S.R., whose catering business is greater than that of any of the other companies, secured an increase of £94,773 in gross receipts, but here again there was a substantial rise in all working costs, which were £186,218 greater than in 1936. Expenditure on maintenance advanced by £80,034, cost of provisions, &c., by £49,218, and salaries and wages by £40,604. The amount transferred from renewal account was £125,002, or £55,582 more than in 1936, but even so the net profit, at £353,009, showed a decrease of £35,863.

The Southern Railway result was very satisfactory. This company disposed of the South Eastern Hotel, Deal, last June, and its catering business is now confined to the Charing Cross and Craven Hotels; the refreshment rooms and restaurant cars being worked by contractors. The gross receipts from hotels last year amounted to £147,518, an increase of £7,618 compared with 1936, and as working expenses declined by £7,215, it was possible to transfer £4,529 to renewal or suspense account (compared with a withdrawal of £1,579 in 1936) and still show a profit of £17,435, an increase of £8,725 over the previous year.

Railway Hotels

The most interesting section of the British railways' catering business is undoubtedly that relating to hotels. The four group companies work 55 hotels, of which they own 54, while they also own but do not work 19 other establishments, making a total of 74. Railway capital invested in hotels at the end of 1937 amounted to £9,634,930, an increase of £207,980 compared with 1936. The L.M.S.R. has by far the biggest capital interest in hotel undertakings, viz., £5,090,609. The railways have kept well abreast of the latest developments in the hotel industry and have spent considerable sums in modernising and enlarging the establishments under their control, with the result that the railway-owned hotels are now able to provide their patrons with accommodation at least equal to the best obtainable elsewhere.

During 1937 the G.W.R. made considerable progress with the modernisation of the Great Western Royal Hotel, Paddington. The work has been undertaken in three stages, the second of which was completed in time for the Coronation. This included the entire internal redecoration and refurnishing of the west wing, provision of a new dining room, improved lavatory accommodation, reconstructed kitchens, larders, &c., refacing and repairing of the hotel exterior, and the construction of a carriage way to the entrance hall. The final stage, now nearing completion, provides for the enlargement and modernisation of the main entrance hall and the renovation of the whole of the remaining bedrooms. With the completion of the scheme, there will be accommodation for approximately 250 people, and, with the exception of a few single rooms, every bedroom will be provided with its own bathroom and will embody all modern improvements.

The L.N.E.R. carried out improvement schemes at several of its hotels, and the work now in hand at the Grand Hotel, West Hartlepool, and the Zetland Hotel, Saltburn-on-Sea, will complete the programme. At both these establishments the public rooms are being modernised and all bedrooms equipped with running water.

The railway hotel event last year was the opening by the Earl of Harewood of the L.M.S.R. Queen's Hotel, Leeds, on November 12. It is not too much to claim that this hotel, which embodies numerous innovations and refinements, is one of the best equipped establishments in the world. Special sound-resisting equipment ensures the elimination of street and other noises, and the layout of the bedrooms and public rooms has been planned on anti-noise principles. It was the first British hotel to have a completely regulated ventilation system enabling 8,000,000 cu. ft. of freshly-washed air to be constantly supplied to the bedrooms and public rooms. There are two banqueting halls accommodating 400 and 100 persons respectively, and every bedroom, of which there are over 200, has its own private bath or bath lobby. At the annual general meeting of the L.M.S.R., Sir Josiah Stamp described the Queen's Hotel as "the latest contribution in Europe to hotel construction," and said that the patronage had so far been very encouraging. The alterations to the company's Midland Hotel, Manchester, have been completed, and the Caledonian Hotel, Edinburgh, is now being modernised.

Buffet Car Services

At the end of last year the railways owned a fleet of 669 restaurant cars and 73 buffet cars. An outstanding feature during 1937 was the introduction of a large number of new buffet car services by the L.N.E.R., which has always favoured this type of catering on short distance express trains. Additional buffet car trains were introduced between London and Cambridge, and 36 trains on the Newcastle-Sunderland-West Hartlepool - Stockton - Middlesbrough, and Leeds-York-Scarborough sections were buffet-car equipped, making a total of 60 trains running daily with buffet cars in the North Eastern Area alone, and over 100 for the whole system.

XUM

Transport Developments in 1937

Abstract of a paper read by Mr. R. Bell, C.B.E., Assistant General Manager, L.N.E.R., to the Institute of Transport, on April 26

In previous years, this review has dealt mainly with principles or economic tendencies, and has said little about the men who have shaped the development of transport. For once it seems fit to break the usual rule in order to record the great work of Sir Eric Geddes. Last June saw the close of his remarkable career—all too early, though its brightest period had ended fifteen years ago. Within the short space of twenty years he rose from a minor post on the old North Eastern Railway to be the first Minister of Transport and the first President of this institute. He d ew up the Act of 1921 under which our railways were "grouped." During the seven years before the war, he gave much thought to schemes for educating and training young railwaymen. But for his efforts at that time, the staff of the L.N.E.R. might not be enjoying their present opportunities for progress.

One link bound Sir Eric Geddes to transport affairs until the last. He became Chairman of Imperial Airways when that company was formed in 1924, and was granted a Government subsidy for flying regular services to the Continent. When, three years later, the Air Ministry decided to give priority to Empire routes, Sir Eric revelled in the planning of air lines from London to India and South Africa. The Empire services constitute about 90 per cent. of the route-mileage operated by Imperial Airways. Their success, judged by a high standard of safety and certainty, led to the conception of the Empire Air Mail scheme which abolished the surcharge on first class mail for South Africa, India, and the East.

In December, a new air mail route was opened to connect Bangkok with Hong Kong and, when the programme is extended this year to cover Australia, a unique development in the history of flying will have been rounded off. The cost has not been extravagant. Subsidies to Imperial Airways have always been granted for specific contracts and on an average represented about 1s. 6d. for each traffic ton-mile worked last year. Comparative figures for 1936 show that the Deutsche Lufthansa was paid 3s. 3d., while Air France then enjoyed an allowance of 7s. 3d. Clearly this country has had good value for its money, but in November a debate in the House of Commons revealed some anxiety about the future of civil air transport, and a committee of inquiry was hurriedly appointed with Lord Cadman as Chairman. The report of this committee, with the Government's observations, was published in March; it does not give an estimate of cost, but emphasises the need for more and larger subsidies. Neither does it advocate working arrangements with the existing network of Continental air systems. The rejoinder of the Government is evidence at once of its prudence and desire to avoid chaotic conditions in air transport. It proposes to ask Parliament to double the aggregate annual amount of air subsidies. The limit will be raised to £3,000,000, but the money will be spent on routes offering substantial traffic.

Unique as the convenience of air communication is, there are few signs that its growth has influenced trading activity overseas. The Cadman Committee assumed that the exchange of commodities would increase if more air services were run. It is difficult to reconcile this belief with the evidence of Lloyd's Register of Shipping. According to that matter-of-fact record, in 1886 more than half of the world's tonnage was under the British flag, whereas today our share is less than one third. The share of foreign tonnage in our trade increases every year. As every working cost has increased during the past two years and the price of new ships has advanced by 40 per cent., our shipowners are hard pressed to keep their flags flying. Shipowners cannot thrive on one-way trade and are now considering a pooling scheme.

It is curious how strong barriers have to be before they stop people and goods from moving about the world. Look, for example, at passenger movement between Great Britain and the Continent. In 1930 Continental travel reached a peak, with a total of 3,054,800 passengers leaving and entering our ports and air stations. Two years later the number had fallen by nearly one-third, but after 1932 the unsettled state of more than one European country and all the jealousies between nations have not stopped a revival. The Board of Trade figures show that in 1937 the record was broken with a total of 3,800,200 passengers, an increase of almost 25 per cent. in seven years. In that period air traffic has multiplied four and a half times, and will soon pass the 200,000 mark. With one passenger in every twenty using the airplane, the Continental steamships are having a stiff fight to maintain their traffic.

In October the Transport Advisory Council issued a report on "Service and Rates." The report suggested that the relationship between rail and road was by far the most important single factor in the general inland transport sphere and formulated proposals for procuring voluntary agreements between these two agencies. In May a committee, over which Sir James Baillie presided, had reported on conditions of employment in the road haulage industry and the Advisory Council is firmly of opinion that, without a settlement of the wages question, no real co-ordination between rail and road will be possible. Faced with the threat of a national strike, road hauliers recently conceded an advance in pay to their employees, but the Government has now introduced a Bill based on the Baillie report.

In contrast to our leisurely progress, France is making another attempt to deal with the transport situation in double quick time. At the end of August a decree was passed for setting up a High Transport Council and the new body is required to co-ordinate all means of transport in the course of 1938. The aim of this ambitious programme is to reduce the deficit on the French railways which has grown like a snowball in spite of increases of about 50 per cent. in rates and charges during the past twelve months. With the same object, the French railway system has been reorganised and placed on much the same footing as the Belgian National Railways.

Fifteen years have passed since our own railways were reorganised. After many vicissitudes, the companies did fairly well in 1929, only to see their earnings fall off again until the lowest depth was reached in 1932. About the middle of 1933 the tide turned. There is a possibility that 1937 may turn out to have been a peak in railway net revenue—it is to be feared that 1929 will remain the pinnacle.

Looking backward over the fifteen years of amalgamation, there does not appear to have been any remissness on the part of the railways in providing an adequate service. Capital to the extent of £26,000,000 has been invested in permanent way, rolling stock, and workshops since 1929. A further sum of nearly £14,000,000 has been put into docks, steamboats, road vehicles, and hotels. Standards of maintenance have been raised to meet the strain of fast-moving traffic and the search for devices to save labour and improve working methods has gone on ceaselessly. A good test of operating efficiency is the average number of net ton-miles moved in a total engine-hour. Last year the L.N.E.R. figure was 501, an advance of 5½ per cent. on 1936. This was the first time that the 500 mark has been reached by any company and was approached without a break since 1932.

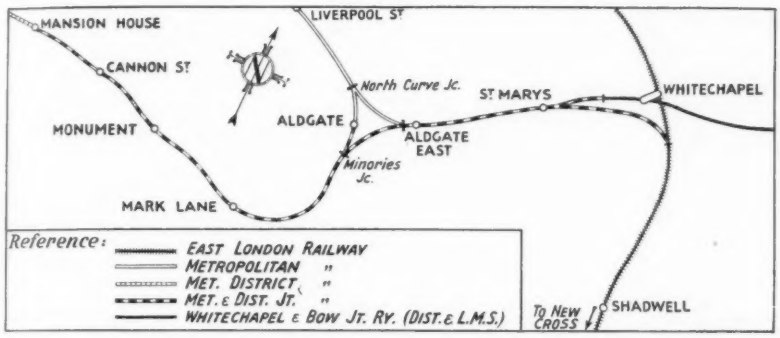
In America the movement to speed up railroad passenger service has shot ahead at an astonishing rate. Last year 15 new streamlined trains were installed, bringing the total number of high-speed trains in service up to 54. These trains vary in size from fourteen cars to three, and their designers have striven to keep the weight as light as is consistent with safety. Courage of no mean order has been shown by the railroads over there in developing passenger facilities at a time when freight traffic is falling off at an alarming pace. Carloadings should average about a million a week in a prosperous year. This year they have never reached the level of 600,000 and the railroads are heading straight for bankruptcy. At the end of 1937 over 30 per cent. of the railroad mileage of the United States was in the hands of the courts. That is a deplorable situation. Day in, day out the American railroads do a marvellous amount of transport, often under trying conditions. There could be no happier development in 1938 than a revival of their prosperity.

XUM

Aldgate Junctions

Present operating difficulties and changes in progress

The layout of Aldgate triangular junction and the great problem it presents to the railway traffic operating department of the London Passenger Transport Board were explained in a paper entitled "Some Phases of Operation on the Underground Railways of London" recently read by Mr. Evan Evans, the board's Operating Manager (Railways), before the Railway Students' Association. Editorial reference to other features of this paper appears on page 822, and was also made in our issue of April 15.



Diagrammatic arrangement of lines around Aldgate, showing pre-grouping ownerships

At this busy flat junction trains on both the Metropolitan and the District services diverge from their parent lines and are interwoven. There are three junctions, viz.; Minories on the south, where the District and Circle services diverge; Aldgate North Curve on the north, where the Metropolitan Barking and New Cross line trains separate from the combined Metropolitan and Circle services—the remainder of the trains proceeding to Aldgate station and, in the case of Circle trains, thence round to Minories junction and the District Line; Aldgate East on the east, just before Aldgate East station, where the District trains from Minories are joined by the Metropolitan Barking and New Cross trains from Aldgate North Curve. The whole of this area is signalled for 40 trains an hour, the main route being from Minories to Aldgate East. The working is exceptionally intricate, and timings must necessarily be arranged to provide the maximum train paths through Aldgate East station. To meet this requirement the times of the trains from the Metropolitan Line to Barking coincide at Aldgate East with the diversion of an inner-rail Circle train at Minories junction to Aldgate, and similarly the time of a train proceeding from Aldgate East to the Metropolitan Line coincides with the departure of an outer-rail Circle train from Aldgate to the District Line. To provide paths at Aldgate East for the Metropolitan Line trains to and from New Cross, it is necessary for an equivalent number of District trains to be curtailed at Mansion House.

The difficulties set up by the junction working at Aldgate East are increased by the presence of yet another junction at the next station, St. Mary's (Whitechapel) where the New Cross trains diverge from the main traffic stream. Within a route distance of just over 1,000 yds. there are, therefore, three flat junctions to be negotiated by each of the train services using Aldgate East, and two stations on the main route to be served. The present layout has been in existence since 1884 and was not designed for modern traffic requirements. The limited facilities at Aldgate East station for handling a large and growing traffic make it extremely difficult to operate satisfactorily a 90-sec. service for a complete hour. The rush hour service is 38 trains an hour in each direction, 12 of which serve the Metropolitan Line, 8 from Barking and 4 from New Cross, and the remaining 26 operate to and from the District Line and Barking and Upminster.

A new Aldgate East station is now being built at the junction of Commercial Street and the Whitechapel and Commercial Roads, about 100 yd. east of the present station; when the work is completed at the end of this year there will be four tracks from the present Aldgate East junction which will, in effect, lengthen the berthing distance for trains standing between Aldgate East and the two Circle line junctions. This will permit of a greater freedom of movement for trains serving Aldgate East, and, combined with longer platforms which will contribute to the quicker loading and unloading of passengers, is expected to enable this section of the line to be operated to its maximum capacity. The Aldgate North curve is also being lengthened to accommodate 8-car trains instead of the 6-car trains to which it is restricted today.

Closing St. Mary's Station on May 1

Since Mr. Evan Evans's paper was read it has been announced officially that St. Mary's station will be permanently closed after the last train on April 30. The new Aldgate East station, when finished, will have entrances in Whitechapel High Street, near Gardiner's Corner, and also by the Whitechapel Library. In making the announcement, the London Passenger Transport Board expresses regret for any inconvenience that may be caused, and points out that the carrying out of the whole scheme is for the general improvement of the service in East London.

CANADIAN NATIONAL RAILWAY COMPANY 1927 GUARANTEED DEBENTURE STOCK.—Notice is given that in accordance with the scheme of arrangement, and the Act of Parliament of the Dominion of Canada under which the above stock was issued, a drawing at par from the total amount of £4,784,109 stock now outstanding will be made in the presence of a notary public on May 25, to the extent of the sinking fund moneys which will be available for the redemption of stock on July 1, 1938, amounting to £191,390. Holders of stock drawn for redemption will be notified immediately after the drawing.

INTERNATIONAL ENGINEERING CONGRESS IN GLASGOW.—The programme has now been issued of the International Engineering Congress which, as recorded in our issue of December 24, will be held in Glasgow from June 21 to 24. Technical sessions will be held in the Conference Hall of the Empire Exhibition on the mornings of June 21 and 22 and the remaining days will be occupied by works visits and excursions. Delegates will be received by the Lord Provost and Corporation of Glasgow on June 21. Full details are available from the General Secretariat of the congress at 39, Elmbank Crescent, Glasgow, C.2.

THOS. FIRTH & JOHN BROWN LIMITED.—For this company the year 1937 was one of continued progress, as was explained by the Chairman, Lord Aberconway, at the recent ordinary general meeting. In most departments the plant had been operated at its fullest capacity. The steel production for 1937 was over 19 per cent. higher than for 1936, and the value of the turnover increased by 34½ per cent. The demand for railway material and for aircraft and automobile steels had continued at a high level, and new bar mills and treatment furnaces had been put into operation to cope with the latter. Exports during 1937 showed a distinct increase over those for 1936, and the increased deliveries to export markets had been generally spread throughout the world. It was a sign of a general improvement overseas that foreign railways were now spending money on the renewal of their locomotives and rolling stock.

XUM

THE QUARTER'S RAILWAY LAW

Engine Drivers' Pensions

O'Brien v. *Great Western Railway Company. The Times, February* 16.

This case was an echo of that part of the amalgamation scheme of 1921 which dealt with the retirement and pensions of servants of the component companies. On the Rhymney Railway the practice was that the engine drivers remained in service as long as they were fit to work, usually to the age of 70. The company had the right, however, in common with other companies, to dismiss a man on 14 days' notice. O'Brien, who was one of the Rhymney engine drivers, had the option in 1921 of accepting the Great Western Railway Company's conditions, or of continuing under the Rhymney Company's conditions, and he chose the latter. In November, 1927, there was an agreement between the men's representatives and the Great Western Railway Company by which the retiring age was fixed at 65, and as consideration for that the pension was raised by 22s. 6d. a week. The question was raised by O'Brien in this action whether that meant that the company must employ the men up to the age of 65, or whether the company still retained the right to dismiss a driver at a fortnight's notice. Owing to the fall in railway receipts in 1932, the company had dismissed 300 of the oldest of the " footplate " staff, including O'Brien, on pension. O'Brien was then 62 years of age and he claimed two and a half years' wages at £3 12s. 6d. a week. Mr. Justice Porter held that the company by the agreement of 1927 merely changed the practice as to the age of the man's retirement and did not abandon its legal right to dismiss individuals should occasion arise, and he gave judgment for the company.

Action against Indian State Railway

Gaekwar's Baroda State Railways v. *Habib-Ul-Haq The Times, March* 19.

The difficulties of suing a State railway are apparent from the above case, which came for appeal before the Privy Council. The respondent (as plaintiff) sued the railway upon contracts for the supply of sleepers which the railway administration declared to be not up to contract. The action was brought in India and objection was taken that in reality, though not in form, the action was brought against H.H. the Gaekwar himself and was therefore not maintainable. The Indian Civil Procedure Code lays down that no action can be brought against a ruling prince except with the consent of the Governor General in Council, and that a certificate to that effect must be signed by the Secretary to the Indian Government. This condition had not been satisfied in the present case. It would seem natural to sue the railway as a corporation, but this presents difficulties because, as was admitted, the railway was " neither a state railway nor a company railway," but was owned and managed by the Maharajah of Baroda through his own men. The point being taken before the Indian Court, the subordinate judge held that the railway was a corporation within the code and could be sued in its own name in the Courts. The High Court of India affirmed this, but on the ground that while it was true that the Gaekwar was owner, the plaintiffs were not suing a ruling prince, but only asking for a decree against the railway, which was his property. This, they said, was lawful so long as the express provisions of the Civil Procedure code were not broken; and that as the owner was carrying on business under an assumed name proceedings could be instituted against him in that name.

Foreign Corporations as " Persons"

The case was the subject of an appeal by the railway to the Privy Council here, which hears Indian and Colonial appeals. Here the respondents (plaintiffs in the action) argued that the question whether a railway was a corporation capable of being sued was one of fact and must be determined by the law of the State of Baroda. Lord Wright said in his judgment in the leading case of *Lazard Brothers & Co. v. Midland Bank Ltd.* (1933 A.C. 289): " English Courts have long since recognised as juristic persons corporations established by foreign law in virtue of the fact of their creation and continuance under and by that law." It was said that by analogy the Courts in India should recognise the railway corporation as a " juristic person," inasmuch as the railway was so established in Baroda.

The answer to this was that the railway was established by H.H. the Gaekwar and consisted of the directors of the railway appointed by him from time to time.

The Privy Council therefore held that the railway had no corporate existence and that the suit could not be maintained, as it was in reality (although not in form) an action against the Gaekwar himself. The point appears to be a technical one, but any other decision would doubtless have had far-reaching consequence upon procedure generally in India. The clear law is that against a ruling prince no action can be brought except in accordance with the Civil Procedure Act, 1908.

Railway Rating in Scotland

Our Scottish friends are so conscientious in reporting cases that one is almost better able to estimate the attitude of the Courts there towards a subject like railway rating than one is in England. The impression gained is that a wide interpretation is given to the phrase " so let out as to be capable of separate assessment," with the result that many matters are excluded from the Railway Roll under the Railways (Valuation for Rating) Act, 1930. The following cases are all taken from the Sessions Cases or the Scottish Law Times for 1937, where they are fully reported:—

In *Austin Reed Limited v. Assessor for Glasgow* the railway companies granted to an advertising agent sole rights of advertising over the Scottish railway system. The companies' receipts were subject to deductions by the agents. The agents sublet to Austin Reed Limited a platform showcase for five years at an annual rent and it was held that the site so let was capable of separate assessment within s. 22 (9) of the Act and must be entered on the roll, with the railway company as landlords and Austin Reed Limited as tenants. The value of the site was held to be the yearly sum paid to the agent and not the percentage payable to the company. Similarly a bookstall let to tenants, and a station cab-hut let to a cab company were held capable of separate assessment.

On the other hand it was held that shops erected on vacant railway land which were unlet for the year 1936-37, were not to be entered on the local Valuation Roll, since they were not " so let out as to be capable of separate assessment."

An interesting case was that of permits granted by the London Midland & Scottish Railway to various persons to shoot rabbits on railway embankments. It was held that these were not a " separate let " of subjects so as to be capable of valuation, and that the receipts should appear in the computation of the cumulative assessment made by the Assessor of Railway and Canals only.

The Hilary Term

Three appeals were decided by the Court of Appeal last term in connection with railway and other transport companies. The first was *Goring v. Southern Railway Company* in which the company's appeal from Hastings County Court was dismissed. The other two were cases in which the London Passenger Transport Board was involved. In *Spevack v. the Board* the plaintiff's appeal from a decision of Mr. Justice Macnaghten was allowed. In *Yeoman v. the Board* the order of Mr. Justice Hawke was varied on an appeal by the board.

The retirement of Lord Hailsham and the appointment of Lord Justice Maughan as Lord Chancellor left a vacancy in the law lords which was filled by the elevation of Mr. Justice Porter, an eminent commercial judge. His place in the King's Bench Division was filled by the appointment of Mr. Asquith, K.C. The appointment is a wise and happy tribute to the new judge's high personal qualifications and to an honoured name.

TELEPHONE NUMBER CHANGE.—The telephone number of the Vickers Train Lighting Co. Ltd., of Vickers House, Broadway, Westminster, S.W.1, has been changed to Abbey 7777.

RAILWAY AND OTHER REPORTS

Assam Railways & Trading Co. Ltd.—A circular has been issued to shareholders by the directors showing approximate figures of the company's railway and colliery business for the year ended March 31, 1938, in comparison with the actual figures for the previous three years. General traffic receipts for 1937-38 were Rs. 12,68,889 and coal traffic receipts Rs. 6,99,411, making total earnings of Rs. 19,68,300 in comparison with Rs. 17,77,166 for 1936-7, Rs. 19,09,951 for 1935-6, and Rs. 19,91,949 for 1934-5. The best general traffic earnings in the four years were those of Rs. 14,83,912 for 1934-5, and the best coal traffic earnings were those for 1937-38. Colliery sales in 1937-8 were 218,470 tons, the best in the four years. Interim dividends on the preference shares were paid on the usual dates but the dividends on the A stock are still in arrear.

Trans-Canada Air Lines.—The operating revenue for the initial period of the company's activities, namely from June 1 to December 31, 1937, of Trans-Canada Air Lines was $16,278, less expenses $25,430. The net deficit on the Vancouver-Seattle service (from September 1 last) was $9,152; organisation and development expenses $93,798; and interest on capital insurance $8,054. The deficit (to be reimbursed by the Dominion subsidy) was $111,005.

Yorkshire Traction Co. Ltd.—This company, which is controlled jointly by the L.N.E.R., L.M.S.R., and Tilling & British Automobile Traction Limited, secured in 1937 a profit of £92,266, against £85,758 for 1936. Adding £11,133 brought in gives a total available of £103,399. Sums of £50,000 and £5,000, respectively, are again appropriated to reserve and to employees' assistance fund, the preference dividend takes £1,704, and the 10 per cent. ordinary dividend requires £35,000, leaving £11,695 to be carried forward. For 1936 the dividend was 10 per cent., but on a capital £50,000 smaller.

Sharpness Docks.—The report for the year 1937 of the Sharpness Docks & Gloucester & Birmingham Navigation Company shows that receipts amounted to £103,994 and expenditure to £54,307, leaving a balance of £49,687. A dividend of 2 per cent. for the year on the ordinary consolidated stock is recommended. The total quantity of goods imported amounted to 713,200 tons, as compared with 724,957 tons in the preceding year, and the exports to 35,863 tons, against 24,075 tons. The directors have provisionally concluded agreements with the Droitwich Canal Navigation Company and the Droitwich Junction Canal Company, whereby those two companies have agreed to support a Parliamentary Bill which the dock company proposes to promote for powers to abandon the Droitwich Canal and the Droitwich Junction Canal. A formal resolution to reduce the number of directors from 15 to 12 was submitted at the yearly meeting on April 13.

Yorkshire Woollen District Transport Co. Ltd.—For the year 1937 the profit was £90,351, compared with £94,602 for 1936. The dividend is unchanged at 10 per cent. for the year, requiring £44,000. Sums of £40,000 and of £7,500 are again transferred to reserve and to employees' assistance fund, respectively. This company is controlled jointly by the L.M.S.R. (with 133,333 shares), the L.N.E.R. (with 66,667 shares), and the British Electric Traction Co. Ltd.

City of Oxford Motor Services Limited.—The accounts of this company, which is associated with the Great Western Railway Company and the British Electric Traction Co. Ltd., show that the profit for the year 1937 amounted to £30,452, in comparison with £26,581 for 1936. Adding £5,765 brought forward makes a total of £36,217, of which £10,871 (against £7,500) is transferred to reserve, £4,810 is applied to preference dividend, and £14,175 to a dividend of 10 per cent., free of tax (the same), on the ordinary shares, leaving £6,361 to be carried forward.

Canadian National (West Indies) Steamships Limited.—This company had an operating profit of $658,538 in 1937, an increase of $101,139 over 1936. Operating revenues were $4,676,684, an increase of $354,091, or 8·19 per cent. Operating expenses were $4,018,146, an increase of $252,952, or 6·72 per cent. Freight revenue increased by $220,932, reflecting better cargoes. Passenger travel was again exceptionally good and passenger revenue increased by $157,700. The advance in operating expenses was due to a general increase in wage and materials costs, additional traffic, and renewals and replacements necessary to maintain the vessels in a high state of efficiency. After payment of bond interest, but before depreciation and interest on Government advances, there is available $188,537·75 which will be paid to the Government in reimbursement in part of prior deficits and interest. The corresponding figure in 1936 was $87,398·55.

Laurence Scott & Electromotors Limited.—Preliminary survey discloses a net profit subject to final audit of £110,000 approximately, after charging £26,000 for depreciation. The directors recommend a dividend of 15 per cent., less tax, on the ordinary and "A" ordinary shares. The directors propose that the £1 ordinary shares should be sub-divided into 5s. shares. They also propose to increase the authorised capital to £700,000, and of this to issue a further 100,000 5 per cent. cumulative redeemable preference shares of £1 each and 160,000 "A" ordinary 5s. shares. Of these shares 144,398 will be offered on bonus terms in the proportion of one in ten to existing ordinary and "A" ordinary shareholders.

Churchill Machine Tool Co. Ltd.—Net profits for the year 1937 amounted to £72,123, compared with £66,744 for the previous year. The final dividend recommended is 20 per cent., making 40 per cent. for the year. This compares with 45½ per cent. for 1936 on a considerably smaller capital. The ordinary capital has been increased from £65,040 to £197,820 and the participating rights of the preference shares have been cancelled. The ordinary dividend for 1937 requires £59,553, whereas for 1936 it required £22,515.

Stewarts and Lloyds Limited.—Dividends are announced on the deferred stock of 12½ per cent. for the year 1937 (against 7½ per cent. for 1936) and at the same rate relatively on the liaison deferred shares. The annual report will be issued on or about May 7 and dividends will be paid on or about May 21, less tax at the rate then ruling, subject to Dominion income-tax relief at the rate of 8½d. for £1 of dividend on the preference stocks, and at the rate of 2¾d. for £1 of dividend on the deferred stock and liaison deferred shares.

Beyer Peacock & Co. Ltd.—The accounts for the year 1937 show a trading profit of £50,749, and a net credit balance of £24,736, which compares with a net loss of £2,456 in 1936. The debit balance of £73,886 as at December 31, 1936, is accordingly reduced to £49,150. The company received at least its full proportion of the increased business in the locomotive industry, and there was a greater demand for Beyer-Garratt locomotives. The order book is at present higher than at any time since 1930, and of the locomotive contracts secured the greater percentage was for engines of the Garratt type.

Dunlop Rubber Co. Ltd.—Total profits of the Dunlop Rubber Group, after writing down of raw materials to market prices where lower than cost, amounted in 1937 to £2,503,926, an increase of £284,770. The parent company secured a net profit of £1,591,017 in 1937 against £1,502,707 in 1936. Adding £589,956 brought in (compared with £589,940) makes a total of £2,180,973 available. Ordinary stockholders again receive 9 per cent. The directors allocate £495,815, against £394,900, to taxation reserve, and increase the appropriation to contingencies reserve from £150,000 to £250,000, leaving £591,429 to be carried forward.

W. T. Henley's Telegraph Works Co. Ltd.—The report shows that the trading profit for 1937, after providing for tax and N.D.C., amounted to £451,838 compared with £402,490 for 1936. Net profits rose from £330,752 in 1936 to £383,112 in 1937. There is again a transfer of £100,000 to reserve account, and the sum of £10,000 is appropriated to pension fund. A final dividend of 10 per cent. and a cash bonus of 5 per cent. are recommended,

XUM

making 20 per cent. for the year. The year's trading has been very satisfactory, and combined with the income received from investments has resulted in a profit which is a record in the company's history.

Albion Motors Limited.—The directors recommend the payment of a dividend of 12½ per cent., less tax, on the ordinary shares for the year 1937. This compares with 15 per cent. for the preceding year. The profit for 1937 was £184,549, from which income tax and N.D.C. take £38,000. Including the amount brought in there is available £181,325. It is proposed to transfer £50,000 to reserve and £5,000 to benevolent fund. There has been another increase in profits, but in view of developments in progress and under contemplation the directors have deemed it advisable to conserve the company's resources.

Richard Costain Limited.—The net profits for 1937 were £62,692, against £71,025 for 1936. A provision of £8,500, against £7,500, is made for taxation, including N.D.C., £10,000 is carried to reserve in respect of contingent liability on deposit with building society and other contingencies, and £4,772 is transferred to preference share capital redemption reserve. Preference dividends absorb £17,228, and the dividend of 5 per cent. on 507,985 ordinary shares requires £25,399, leaving £28,876 to be carried forward. Contract works have been carried out by the company during the year, including work for the Iranian Government, London County Council, local authorities, and important companies. In conjunction with the Westminster City Council, two types of air raid shelters of proved efficacy have been erected at Caxton Hall.

Birmingham & Midland Motor Omnibus Co. Ltd.—For the year 1937 this company, which is jointly controlled by the L.M.S. and G.W. Railway Companies and by the British Electric Traction Co. Ltd., secured net traffic receipts of £641,903, together with interest and dividends of £15,427. The balance of the profit and loss account for the year amounted to £259,486. After deducting £64,321 placed to reserve and adding £72,280 brought forward, there is a sum available of £267,445 out of which it is proposed to apply £8,000 to dividend of 8 per cent. for the year on the cumulative preference shares, £120,000 to dividend of 10 per cent. for the year, and £60,000 to a 5 per cent. bonus, on the ordinary shares, carrying forward £79,445. The dividend and bonus are at the same rates as for the previous year. During the past year trade in the areas served by the company was very good and the number of passengers carried was substantially greater than for the previous year. Wages of the company's employees were increased during the second half of the year. A freehold garage for 70 omnibuses has been constructed at Oldbury and the garage at Coalville has been enlarged.

RAILWAY AND OTHER MEETINGS

San Paulo (Brazilian) Railway Co. Ltd.

The annual general meeting of the San Paulo (Brazilian) Railway Co. Ltd. was held at Southern House, Cannon Street, London, E.C., on April 26, Mr. Oliver R. H. Bury, M.Inst.C.E., Chairman of the company, presiding.

The London Manager and Secretary (Mr. Vernon Hinde) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said the results of the year revealed a continued growth in the traffic of the railway. The receipts in currency of the railway as a whole (including the Bragantina section), amounted to 136,307 contos of reis in comparison with 130,195 contos of reis in the previous year. In sterling, these receipts were equivalent to £1,691,778 converted at the average rate of their remittances of 2·97877d. to the milreis, a rate slightly higher than in 1936, when the equivalent in sterling was £1,550,096, or an increase of £141,682, or 9·1 per cent.

The working expenses were 94,589 contos of reis against 85,886 contos of reis, or, expressed in sterling converted in the same manner as the receipts, £1,174,000 in 1937 compared with £1,022,556 in the previous year. The net profit resulting, after deduction of London office expenses, interest on stores and pension fund, Brazil, was £410,637 compared with £426,927 in 1936. There remained a final balance of £147,000, out of which the directors proposed the final dividend of 2½ per cent., less income tax, on the preference stock, making 5 per cent. for the year, and a final dividend of 2 per cent., free of income tax, on the ordinary stock, which with the interim dividend paid in October last made 4 per cent. for the year, carrying forward the sum of £62,000 compared with £33,800 brought into the account.

Passenger traffic increased by 8 per cent. and was fairly steady throughout the year. First class travel was not equal to the record for this traffic of 1929, but the difference was made up by second class, which increased by 24 per cent: The traffic between Santos and San Paulo showed continued and satisfactory increase, and there was reason to think that the road competition had been fairly met and was not now showing signs of considerable growth. In goods at 5,975,000 tons, there was an increase of 7 per cent. in spite of a decrease of 12 per cent. in coffee. In merchandise, there was an increase of 3 per cent. The greater part of the increase in goods traffic was in the lower classifications, a fact which had added considerably to the cost of operation in relation to gross receipts. To meet the activity in traffic, the company had provided in all sixteen locomotives and 300 wagons, 200 of which were of high capacity. Improvements to the line were effected by the modification of shunting yards, the extension of sidings, and the provision of new sheds.

With regard to the prospects for the current year, the traffic receipts to date were 40,720 contos of reis, or in sterling (at the average rate of exchange for such remittances as the company had received) £450,635 compared with 38,644 contos and £479,669 for the same period last year. In his report, the Superintendent of the company said that without counting too much upon a recovery in the declining figures of coffee traffic, they were at present entitled to expect that the gross traffic offering this year would, at least, be as great as that of last year.

The report and accounts were unanimously adopted.

SKEFKO BALL BEARING CO. LTD.—The net earnings of the Skefko Ball Bearing Co. Ltd. for the past year showed an increase of £39,656, or 16·8 per cent., as was explained by the Chairman (Sir Ralph G. C. Glyn, M.P.) at the recent annual meeting. During the year the factory plant was kept working to maximum capacity, and the sales of SKF ball and roller bearings were record figures. The export business showed an increase. The orders on hand at the end of 1937 were at the highest level ever reached in the history of the undertaking. For the first three months of the current year trading results showed some improvement.

COLVILLES LIMITED.—All the subsidiaries of Colvilles Limited had a successful year in 1937. In stating this at the recent annual general meeting, the Chairman (Mr. John Craig) explained that the customers of each of the subsidiary companies had in reality at their disposal the resources of the whole group. With the completion of the coke ovens and blast furnaces now under construction a reasonable proportion of the pig iron requirements of the group would be manufactured in plant of the most modern design. At the same time, by the linking together of the coke ovens, blast furnaces and steel furnaces, the company was ensuring that the cost of producing steel would be thoroughly economic. The volume of output of the company and its subsidiaries for the year 1937 exceeded that of 1936 by 12 per cent. The company was still busy and had contracts to execute which should ensure good employment for some time. The output for 1938 was substantially more than at the corresponding period of last year.

MINISTRY OF TRANSPORT ACCIDENT REPORT

Crewe, L.M.S.R.: November 16, 1937

At about 4.25 a.m. the 8.30 p.m. express from Perth collided at 15 m.p.h. with the 10.30 p.m. express from Glasgow which had just restarted from Coal Yard signal box home signal; 20 persons received minor injuries and the guard of the Glasgow train was detained in hospital. All six vehicles of that train were considerably damaged in almost equal degree, without derailment, telescoping or buffer-locking. In the Perth train there was telescoping between the leading vehicle, a horsebox, and the following bogie brake van. There was a dense fog, with visibility only a few yards. Fogmen had been out several hours. Major G. R. S. Wilson conducted the inquiry. (The arrangement of lines and signals is shown on the accompanying diagram.)

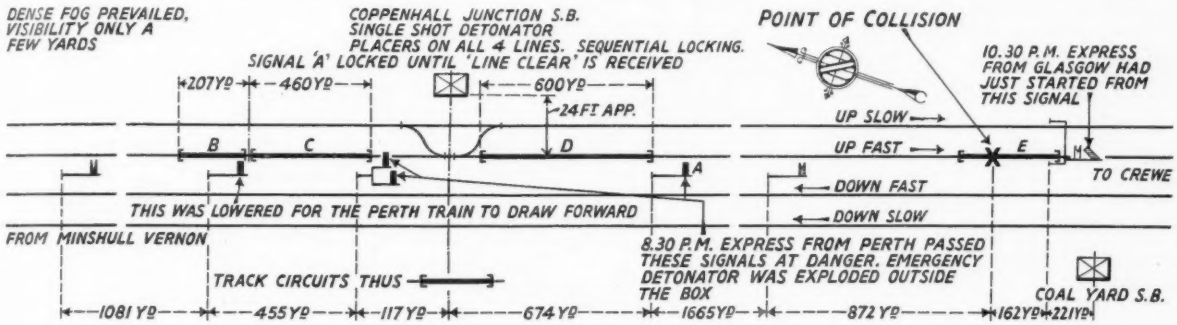


Diagram showing point of collision and arrangement of signals and track

The Glasgow train passed Coppenhall Junction box at 4.3 a.m. and was stopped at Crewe Coal Yard home signal for the 2.30 a.m. train from Liverpool to clear the section to Crewe North Junction. Signalman Fleet, Coppenhall Junction, accepted the Perth train and received "entering section" from Minshull Vernon at 4.14 a.m.; he kept his signals at "danger" and placed a detonator on the up fast line. He waited till track "B" had been occupied for 30 to 40 sec., and lowered the outer home for the train to draw up to the inner home and then to the box. Very shortly after he saw the headlights approaching only a few yards away at about 15 to 20 m.p.h. He rushed to the window, shouting and holding both arms above his head. The detonator exploded with a good report and flash. He just saw the driver; although he had no acknowledgment to his shout, he felt the driver would stop at the starting signal, and did not send "train running away" until track "D" had been occupied and cleared. He received "obstruction danger" at 4.27 a.m. He had no time to show a red light to the driver and did not think to show one to the guard, whom he did not see.

D. Walley, tail-lamp man, was surprised the train did not stop when the detonator was exploded and spoke to Fleet, who said the section ahead was not clear. Twelve of the detonators on hand were subsequently tested and found satisfactory.

Driver W. J. Nicholson, of the Perth train, said he was thoroughly acquainted with the road, but appeared uncertain of the number of stop signals at Coppenhall Junction. He exploded a detonator at the distant signal, and continued slowly to "the home signal," which was at clear. He saw only one and could not say whether it was the outer or inner. He was sure he heard no detonator at the box; he shouted "Are we right away?" but heard no reply. The signalman seemed to be waving one arm; he took this as an intimation that all signals were clear. He looked for but did not see the starting signal. He exploded a detonator at the Coal Yard distant and was preparing to stop when his fireman called that there was a tail lamp close ahead.

Fireman H. Evening generally confirmed this. He heard no detonator at Coppenhall Junction box but did hear those at the distant signals. He saw none of that box's signals; when Nicholson told him they were right away he started firing. The engine was not blowing off.

Guard A. J. Washington said he would have seen a red light had the signalman shown one; he saw him at the window. He heard no detonators anywhere and was unlikely to, so far back. Later the signalman told him he had "shot the train at the box"; he repeated this to Driver Nicholson, who contradicted it.

Signalman A. Moores, Crewe Coal Yard box, on receiving "train running away" at 4.20 a.m., sent the fireman of the Glasgow train, who had come to the box, to tell his driver to draw forward. The train being accepted at 4.21 a.m., he lowered his home signal. An appreciable time elapsed before he heard the collision. He also sent a tail-lamp man to tell the logman at the signal to try and stop the Perth train. The latter shouted to Driver Costerdine of the Glasgow train, who opened his regulator, but the collision took place.

Inspecting Officer's Conclusions

Major Wilson concludes that the main responsibility must rest with Driver Nicholson. There is little doubt that a detonator was exploded at Coppenhall Junction box. It is unfortunate—and difficult to understand—that it was not heard, but there is no reason to doubt the good faith of the enginemen's statements.

This does not excuse Driver Nicholson. He had seen only one of the two stop signals in rear of the box; it was showing a green light and he was not certain whether it was the outer or inner home. It is clear it was the outer home, and, as it is 572 yd. from the box, Nicholson should have realised the possibility, if not the probability, that he had missed the inner home. In such circumstances a dead stop is prescribed by the rules; he should have stopped to obtain verbal assurance as to the position, but relied, unjustifiably, on a glance of the signalman's upraised arm as intimation that the section was clear, a type of signal always liable to misinterpretation, and more so under the prevailing conditions. Major Wilson is not convinced that Nicholson's knowledge of the road was satisfactory. He has a fairly good record and has been a driver for 18 years.

Signalman Fleet was slow to appreciate the situation, and display a red light to Guard Washington who no doubt was watching the box as he passed. A detonator exploded at a signal box requires an immediate stop, and Fleet should have realised that the driver was likely to miss the starting signal. The train probably passed at about 20 m.p.h.; nearly 1½ min. would have elapsed before the train cleared track circuit "D." Had "train running away" been sent much earlier, it is likely that the accident would have been averted. Although it appears that Fleet endeavoured to carry out Rule 39 (*a*) at the outer home, it is to be regretted that he did not make sure the Perth train had come to a stand before lowering the signal.

Signalman Moores, the fireman of

the Glasgow train, and the staff on the ground, were alert and made every effort to bring the Glasgow train within the home signal.

Remarks and Recommendations

The outstanding feature of this case was the enginemen's failure to hear the emergency detonator at Coppenhall Junction box, although they heard detonators at distant signals shortly before and after. Major Wilson has little doubt the detonator exploded and that the sound was not less than usual. Under the trying conditions of fog, when detonators are being exploded at comparatively frequent intervals and by trains on adjacent lines, enginemen may, on rare occasions, fail to notice an audible signal.

With semaphore signalling safe operation in fog depends on the detonator; on the whole, the system works well, a tribute to the vigilance of enginemen. From the footplate of an engine with long wheelbase, the sound is not necessarily startling. The modern enclosed cab may tend to obscure external sounds and accentuate ordinary noises on the footplate.

Detonator placing apparatus is of great value, especially where sections are short and traffic is frequent. Unlike that exploded at a distant signal, an emergency detonator requires an immediate stop, but, with a single-shot machine, the sound heard is no different. In protecting a train stopped in section, reliance is not placed on a single detonator. Similarly the company's latest practice is to provide two-shot machines at signal boxes; the two detonators are 24 in. apart, and, although the two explosions will be merged except at the lowest speeds, the increased volume of sound should materially lessen the not negligible risk of missing the emergency signal.

In addition to accelerating the provision of machines at signal boxes generally, Major Wilson considers that the company should be asked to consider replacing the single-shot by the two-shot type.

British Canal Traffics

Tonnage on inland waterways for the past three years

We have received from the Ministry of Transport statistics relating to the tonnage of goods and minerals over a number of canals and waterways in Great Britain during the years 1935, 1936, and 1937. Of these canals 23 are railway-owned, and the total traffic conveyed upon them was 1,663,250 tons in 1937, against 1,773,472 tons in 1936, and 1,754,509 tons in 1935. Figures are also given of ten selected classes of traffic carried by these canals, amounting to 1,258,043 tons in 1937, compared with 1,345,993 tons in 1936 and 1,279,939 tons in 1935. The largest traffics conveyed in 1937 were: coal, coke, patent fuel, and peat 492,286 tons; agricultural produce and foodstuffs 205,585 tons; liquids in bulk 167,836 tons; and building materials (other than wood) 160,329 tons.

The canals described as other than railway-owned number 24, and the volume of traffic conveyed over them was 16,906,841 tons in 1937, compared with 17,075,114 tons in 1936, and 16,357,041 tons in 1935. Of the ten selected classes of traffic the amount carried was 13,100,277 tons in 1937, against 12,890,043 tons in 1936, and 12,513 785 tons in 1935. Coal, coke, patent fuel, and peat provided far the largest tonnages, which advanced from 6,067,275 in 1935 to 6,221,459 in 1936, and 6,310,460 in 1937. Of agricultural produce and foodstuffs 1,192,819 tons were conveyed in 1937. Raw materials provided 1,097,526 tons in 1937. The tonnage of liquids in bulk advanced from 919,295 in 1935 to 984,526 in 1936 and to 1,091,100 in 1937; and the 939,395 tonnage of building materials (other than wood) in 1937 also showed a progressive increase.

TONNAGE OF GOODS AND MINERALS CONVEYED OVER THE UNDERMENTIONED CANALS AND WATERWAYS IN GREAT BRITAIN DURING THE YEARS 1935, 1936, AND 1937

Canal or Waterway	1935	1936	1937
Railway-Owned	Tons	Tons	Tons
Southern Railway :—			
Gravesend and Higham	28,910	25,529	30,066
Great Western Railway :—			
Kennet and Avon	17,040	14,738	13,863
Monmouth, Brecon, & Abergavenny	147	103	98
Stourbridge Extension	40,740	27,348	29,730
Stratford-on-Avon	2,469	3,274	1,162
London Midland & Scottish Railway :—			
Ashby	11,097	10,347	13,530
Cromford	19,905	15,597	15,902
Forth and Clyde	130,819	133,069	129,181
Huddersfield	21,995	20,556	15,778
Lancaster (North End)	33,183	29,568	21,667
Manchester, Bolton, & Bury	91,840	91,174	92,816
Shropshire Union	293,842	256,646	243,527
St. Helens	108,127	111,139	100,628
Trent & Mersey	323,733	319,080	310,153
London & North Eastern Railway :—			
Ashton, Macclesfield, & Peak Forest	45,004	46,489	35,168
Boroughbridge & Ripon	59,660	63,055	66,335
Chesterfield	23,861	16,310	18,070
Fossdyke Navigation	75,935	73,707	69,410
Nottingham	108,290	96,988	64,754
Union	6,632	2,379	428
Witham	3,295	2,086	2,900
Southern, G.W., and L.M.S. Jt. :—			
Kensington	139,403	228,623	203,480
L.M.S. and G.W. Jt. Committee :—			
Lydney Harbour and Canal	168,582	185,667	184,604
Total	1,754,509	1,773,472	1,663,250

Canal or Waterway	1935	1936	1937
Other than Railway-Owned	Tons	Tons	Tons
Aire & Calder	2,337,922	2,460,823	2,813,432
Birmingham	2,674,155	2,611,678	2,447,040
Bridgwater	1,112,701	1,126,352	1,085,638
Calder & Hebble	246,493	252,130	271,677
Caledonian	13,654	12,725	20,605
Coventry	383,917	381,960	365,075
Crinan	71,408	66,984	72,685
Glamorganshire	65,345	72,858	86,892
Gloucester & Berkeley	403,747	460,318	502,934
Grand Union	2,237,091	2,500,415	2,118,722
Lee Navigation	1,735,639	1,846,945	1,803,461
Stort Navigation	8,358	9,126	7,680
Leeds & Liverpool	1,529,840	1,550,311	1,513,386
Oxford	354,016	395,988	387,498
Rochdale	35,508	34,575	27,377
Severn Commission	256,041	283,977	325,959
Sheffield & South Yorkshire	670,982	771,264	815,233
Staffordshire & Worcestershire	492,217	483,000	464,482
Stourbridge	85,133	68,736	72,219
Stroudwater	1,221	1,128	795
Thames (above Teddington)	317,211	335,418	316,638
Trent Navigation	561,909	581,097	596,471
Weaver	626,779	622,309	650,298
Worcester & Birmingham	135,754	144,997	140,644
Total	16,357,041	17,075,114	16,906,841
Grand total	18,111,550	18,848,586	18,570,091

NOTES AND NEWS

Renaming "Clown" Station.—The L.N.E.R. announces that from May 2 Clowne station will be renamed "Clown & Barlborough." This station is on the Sheffield-Shirebrook-Mansfield line.

Capital Expenditure on U.S.A. Railways in 1937.—Capital expenditures by the Class I railroads of the U.S.A. for equipment and other improvements to railway property amounted to $509,793,000 in 1937, compared with $872,608,000 in 1930.

World Power Conference, 1938.—It is announced officially that, notwithstanding recent political events, the Vienna Sectional Meeting of the World Power Conference will be held between the dates already fixed (August 25-September 2), and that the programme remains unaltered.

L.N.E.R. Train Arrangements for Glasgow Exhibition.—L.N.E.R. arrangements for sponsoring travel to the Glasgow Empire Exhibition include the running of over 750 special excursion trains in Scotland. Cheap day-ticket facilities will be extended to within a 60-mile radius of Glasgow, including Perth and Dundee. Numerous evening excursions will be advertised, and from certain stations combined rail and exhibition tickets will be issued. Ordinary train services will be strengthened as required.

Horsham Station Reconstruction.—The reconstruction of Horsham station, in preparation for electrification, is well advanced. The platforms are being extended to 820 ft. to accommodate the longest electric trains, and a new up loop line is being provided. An entirely new block of buildings is being constructed to the north of the original station forecourt on the up side. In addition, a passimeter booking office, with a station forecourt for the use of motorcars, is being provided on the down side. The subway is being replaced by a new passenger footbridge, together with a luggage bridge connected with the parcels office on the up side and the platforms by means of lifts. New platform buildings and roofing are being provided.

Trade Agreement Affecting Transandine Railway.—A Reuters message from Santiago (Chile) states that an additional trade agreement, to increase the Transandine international railway traffic, has been signed by Chile and Argentina. Chile will permit the importation duty-free of 60,000 head of cattle each year, further importations being subject to a sliding tax. Under the terms of the agreement, Argentina has reduced import duties on Chilean beans, lentils, timber, sulphur, and nitrate. The two Republics have also agreed to abolish passports for travel over the Transandine Railway and road routes, to develop tourist traffic. Chileans and Argentines will have only to show their customary identification cards to the frontier police.

British Glass Convention.—The fifth British Glass Convention will be held at Droitwich, from May 18 to May 21. The offices of the convention are at Norwich House, 13, Southampton Street, High Holborn, London, W.C.1.

Fatal Accidents in U.S.A. during 1937.—Only three passengers lost their lives in 1937 in train accidents on U.S.A. railways; the fatalities occurred in two accidents on two separate railways within two days in November. The corresponding number in 1936 was seven passengers.

Indian Mail Train Hold-Up.—According to a Reuters message from Bombay, 15 youths armed with knives and firing revolvers at random, raided the postal van of a mail train on the Bengal & North Western Railway, near Allahabad, on April 11. Having pulled the alarm chain, they stabbed the police constable on the train, bound the guard, and decamped with 25 insured packages and £20 in each. Nobody was hurt in the shooting.

German State Railway Fuel Consumption.—As a result of modernising the locomotive stock and various other working improvements, says a Reuters message, there has been a fall in fuel consumption on the German State Railway from 53·8 tons per million kilometres run in 1935 to 51·8 tons in 1936 and 50·9 tons in 1937. The total coal consumption in 1937 was 15,500,000 tons, or about 1,000,000 tons more than in the previous year, owing to the greater number of trains run.

Revised Irish Sailings.—The Great Western Railway Company announces that from Monday, May 2, the service to and from Ireland *via* Fishguard and Waterford will be twice weekly in each direction. The boat will leave Fishguard harbour at 12.20 night on Mondays and Fridays for Waterford, and will leave Waterford at 5.25 p.m. on Tuesdays and Saturdays for Fishguard. There will be rail connections with every sailing from and to principal stations in England, Wales, and Ireland. The boat at present leaving Waterford on Wednesdays at 5.25 p.m. for Fishguard will be discontinued, and will not run on Wednesday, May 4, and Wednesdays thereafter.

Zone Tickets in France.—The French National Railways are now issuing day return (Sundays) and week-end tickets from Paris to stations within a radius of approximately 100 km. (62 miles). Stations are grouped in five zones, with uniform fares to all in a given zone. Passengers may travel outwards to the station desired, and return from any one in the same zone, or in a zone nearer Paris. If it is desired to return from a zone beyond that for which the fare has been paid, the appropriate difference is charged. The Sunday fares range from fr. 8 third and fr. 12 second class for Zone 0, to fr. 30 third and fr. 40 second class for Zone 5. The week-end tickets are at slightly higher fares, and are available from Friday to Sunday, or from Saturday to Monday.

Djibouti-Addis Ababa Railway Manager Visits Kenya.—M. Michel Pasteau, General Manager of the French Djibouti-Addis Ababa Railway in Abyssinia, is visiting Kenya with a view to examining the Kenya & Uganda Railway system in connection with future developments projected for his own line. The developments include a large increase in rolling stock.

Spanish Electric Line Reverts to Steam.—According to information received by Spanish Press Services Limited, the Barcelona-Puigcerdá railway, which was electrified some years ago, has had to revert to steam locomotive power, as a consequence of the capture by the Nationalist forces of the main power stations in Catalonia. The service on the railway has been reduced by half, and the journey takes twice as long.

The Status of the Engineer.—The committee formed at a meeting of engineers held in November last to discuss suggestions for the improvement of the status and salary of the engineer (see THE RAILWAY GAZETTE of March 25), hopes to present its report to a meeting in the Caxton Hall, London, at 7 p.m. on May 16. Copies of the report will be issued to all who are interested in the project to the extent of contributing 2s. 6d. towards the costs of printing, and hiring the hall. So far as it is possible to anticipate the report, it has been decided that it will be necessary to form an organisation devoted primarily to objects such as maintaining and improving the status of the engineer and his position as a valuable member of the community, such objects being outside the scope of the charters of the major engineering institutions. The Honorary Secretary of the committee is Mr. F. W. Yates, 62, Parkview Court, Hurlingham, S.W.6.

L.N.E.R. Pictorial Posters Exhibited in Edinburgh.—The fifteenth annual exhibition of L.N.E.R. pictorial posters was held in Waverley station, Edinburgh, from April 6-8. Mr. George Mills, Divisional General Manager, Scottish Area, L.N.E.R., presided at the opening, which was performed by Mr. W. Y. Darling, Treasurer of the City of Edinburgh. An outstanding exhibit was Mr. J. McIntosh Patrick's painting for a poster of North Berwick, and by the same artist Royal Deeside was well portrayed by a scene typical of that district. The East Coast resorts of England served by the L.N.E.R. were also well represented by designs in a variety of styles and colours. Prior to the opening of the exhibition, Mr. Mills presided at a luncheon to the Press, given in the North British Station Hotel, Edinburgh,

and in proposing the toast of "The Press," stated that the railway companies had 12,500 advertisements on behalf of Scotland in more than a hundred newspapers, and distributed half a million booklets and folders.

Sydney Harbour Bridge Profit.—During the first half of the current financial year Sydney Harbour bridge accounts showed a profit of £34,352, and it is expected that the full year also will show a surplus. This is the more remarkable in that contributions from municipalities, &c., have now ceased. Roughly 22 per cent. of the revenue in the half year was derived from railway passenger tolls, according to a British United Press message from Sydney.

New L.M.S.R. Laundry at Leeds.—The L.M.S.R. announces that a new laundry at Hunslet, Leeds, which is being built in connection with the company's hotel services, will be opened in May. The laundry, built upon a site formerly occupied by stables, will have a floor space of 8,000 sq. ft. It will give employment to between 30 and 40 people, and will be capable of dealing with 50,000 articles a week, ranging from hotel sheets to visitors' personal laundry. The construction work is being carried out by a Leeds firm, while the equipment, consisting of three washing machines and two electrically driven hydros, is being provided by Manchester and Huddersfield firms respectively.

Rail-Air Tickets by North Eastern Airways.—Return halves of tickets for the internal services of North Eastern Airways Limited (except those for the throughout journey between London and Glasgow), may now be exchanged at L.M.S.R. and L.N.E.R. booking offices for the corresponding first class rail single ticket. Similarly, holders of L.M.S.R. and L.N.E.R. return tickets between points served by North Eastern Airways (again except London-Glasgow), may exchange their return halves for single-journey air tickets at North Eastern Airways offices on payment of the appropriate supplement. The company's internal system consists of a main line from London to Perth *via* Doncaster, Newcastle, and Edinburgh. Connections are made at Doncaster with Leeds, Bradford, and Hull; and at Newcastle with Glasgow.

Increase in L.M.S.R. Exceptional Loads Traffic.—Over 3,400 exceptional loads were carried on the Western Division of the L.M.S.R. during the last year, equal to an increase of 700 over 1936. Machinery of all descriptions, a complete automatic telephone exchange, the world's largest hollow steel forging, ship's lifeboats, locomotives for export, coaches, and electricity transformers were among the varied articles transported to all parts of the country. In connection with nearly 700 of these consignments it was necessary for special notices to be printed and issued to the staff advising them of the running of these exceptional loads and the route over which they must travel. For the transportation of these loads the L.M.S.R. maintains a stock of over 200 wagons varying from 20 to 120 tons in capacity. In some cases it was necessary for the lines to be slewed at certain points, and such obstructions as signal arms and workmen's huts to be temporarily removed until the traffic had passed.

Crewe Pupils and Premiums Dinner.—The 48th annual dinner of Crewe Pupils and Premiums is to be held at the Trocadero Restaurant, Piccadilly, London, on May 13, at 7.15 p.m. for 7.45 p.m. The guest of honour will be Mr. O. V. S. Bulleid, M.I.Mech.E., Chief Mechanical Engineer of the Southern Railway, and Mr. J. Shearman will be in the chair. Tickets (12s. 6d. for past Crewe men and guests, or 5s. for present pupils, premiums, and apprentices) from the Secretary, Mr. Reginald Terrell, of Terrell's Wharf, Townmead Road, Fulham, S.W.6.

Swiss Mountain Railway Electrification.—A popular excursion from Montreux is the ascent of the Rochers de Naye, by funicular to Glion, thence by mountain railway over the Gorges du Chauderon, commanding magnificent mountain panoramas. Hitherto the railway from Glion has been steam-hauled. Now it is to be electrified and railcars of a new design will be put into operation during the coming summer season. Full details of the new service are not yet available, but it is understood that a considerable saving in journey time will be effected, as compared with the present steam trains.

An Excursion at 90 m.p.h.—On Tuesday last a party of 670 boys from public and private schools, members of the Crusaders' Union, was carried by the L.N.E.R. between King's Cross and Cranwell Air Station of the Royal Air Force, for a flying demonstration. Between King's Cross and Grantham a vestibuled train of 14 coaches, weighing 470 tons empty and 500 tons with the passenger complement, was worked in each direction by the streamlined "A4" Pacific No. 4498, *Sir Nigel Gresley*. Special arrangements were made for the service of luncheon and tea to the 670 passengers from three kitchen cars on the train each capable of catering for 240 people. The service of meals to so large a number at one time is believed to be a record in railway catering, at least in this country. Other notable features of the excursion are referred to editorially on page 823.

Institution of Railway Signal Engineers.—At the provincial meeting in Birmingham on April 27, members paid a visit to the Witton works of the General Electric Co. Ltd., and were entertained to tea, when they were welcomed by Dr. Garrard, Chief of the Transformer and Switch Gear Department. In the evening a paper entitled "Principles of Selectivity as Applied to Railway Telephony and Telegraphy" was read by Mr. R. P. Quelch, Associate Member. In the discussion the following spoke: Messrs. R. C. Woods, J. B. Griffiths, J. Boot, C. A. Brown, T. S. Lascelles, A. Brown, J. E. Mott, and the President, Mr. G. H. Crook. Members of the Birmingham branch of the Signal and Telegraph Technical Society, which is affiliated to the institution, were also present. The next meeting will be held in London on May 25, when a paper on "Gravity Yards" will be read by Mr. J. C. Kubale, member.

Relation between Track and Rolling Stock.—In his presidental address to the 39th annual convention of the American Railway Engineering Association at Chicago on March 15, Mr. J. C. Irwin mentioned that the investigation of the relation between track and rolling stock had been reinitiated through a joint committee of the A.R.E.A. and the Mechanical Division of the A.A.R.

Message from the Chairman of Cable & Wireless Limited.—Last Monday we received the following message: "On the inauguration today of the reductions in overseas telegraph charges under the new Empire flat rate scheme I venture to hope that our desire to serve in this way the social and commercial interests of the Empire may be fulfilled and that in particular it may bring benefit to your own undertaking.—Edward Wilshaw, Chairman, Cable & Wireless Limited."

Air Line Unification in Scotland.—The air services in Scotland of Northern & Scottish Airways Limited and of Highland Airways Limited will henceforth be operated by the recently-formed Scottish Airways Limited. An affiliated company known as Western Isles Airways Limited has been formed to operate the former Northern & Scottish services from Glasgow to the Hebrides and the Western Isles. The companies concerned in this unification of ownership are British Airways Limited, David MacBrayne Limited, and the London Midland & Scottish Railway. On April 26, Scottish Airways inaugurated a service between Renfrew (Glasgow) and Perth that provides Glasgow with air connections with the Highlands, the Orkneys, and Shetlands.

New Peiping-Jehol Railway.—Describing his journey as the first foreigner to travel by the new Peiping-Jehol Railway—the opening of the first section of which was reported in our issue of April 8 (p. 732)—the *Daily Telegraph* correspondent, states that the distance between Peiping and Jehol is 137 miles. The new line climbs from the plains round Peiping to the Jehol plateau, with four (or five) reversing stations, through a vertical height of 2,000 ft. There are, he says, 12 tunnels, one of them over a mile in length, and construction work in general has been very heavy. It is remarkable that it has so far occupied only six months, and from what the correspondent says, it would appear that the track is laid throughout, though only the first 60 miles are officially open.

XUM

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 16th Week			Totals to Date		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,855½ mls.)						
Passenger-train traffic...	478,000	432,000	+ 46,000	6,772,000	6,579,000	+ 193,000
Merchandise, &c. ...	410,000	531,000	– 121,000	7,676,000	7,825,000	– 149,000
Coal and coke ...	182,000	269,000	– 87,000	4,502,000	4,539,000	– 37,000
Goods-train traffic ...	592,000	800,000	– 208,000	12,178,000	12,364,000	– 186,000
Total receipts	1,070,000	1,232,000	– 162,000	18,950,000	18,943,000	+ 7,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	324,000	295,000	+ 29,000	4,443,000	4,365,000	+ 78,000
Merchandise, &c. ...	294,000	384,000	– 90,000	5,371,000	5,397,000	– 26,000
Coal and coke ...	202,000	260,000	– 58,000	4,215,000	4,160,000	+ 55,000
Goods-train traffic ...	496,000	644,000	– 148,000	9,586,000	9,557,000	+ 29,000
Total receipts	820,000	939,000	– 119,000	14,029,000	13,922,000	+ 107,000
G.W.R. (3,737 mls.)						
Passenger-train traffic...	216,000	176,000	+ 40,000	2,842,000	2,762,000	+ 80,000
Merchandise, &c. ...	142,000	211,000	– 69,000	3,096,000	3,100,000	– 4,000
Coal and coke ...	75,000	119,000	– 44,000	1,896,000	1,868,000	+ 28,000
Goods-train traffic ...	217,000	330,000	– 113,000	4,992,000	4,968,000	+ 24,000
Total receipts	433,000	506,000	– 73,000	7,834,000	7,730,000	+ 104,000
S.R. (2,147 mls.)						
Passenger-train traffic...	317,000	280,000	+ 37,000	4,423,000	4,280,000	+ 143,000
Merchandise, &c. ...	57,000	69,500	– 12,500	954,500	961,500	– 7,000
Coal and coke ...	21,000	29,500	– 8,500	546,500	551,500	– 5,000
Goods-train traffic ...	78,000	99,000	– 21,000	1,501,000	1,513,000	– 12,000
Total receipts	395,000	379,000	+ 16,000	5,924,000	5,793,000	+ 131,000
Liverpool Overhead ... (6½ mls.)	1,360	1,210	+ 150	21,136	18,922	+ 2,214
Mersey (4½ mls.) ...	4,722	4,221	+ 501	70,855	67,967	+ 2,888
*London Passenger Transport Board ...	578,500	584,900	– 6,400	24,172,000	24,088,500	+ 83,500
IRELAND						
Belfast & C.D. pass. (80 mls.)	3,735	1,721	+ 2,014	29,264	27,781	+ 1,483
,, ,, goods	334	530	– 196	7,075	7,987	– 912
,, ,, total	4,069	2,251	+ 1,818	36,339	35,768	+ 571
Great Northern pass. (543 mls.)	14,900	7,750	+ 7,150	138,050	133,100	+ 4,950
,, ,, goods	7,100	11,850	– 4,750	139,200	152,600	– 13,400
,, ,, total	22,000	19,600	+ 2,400	277,250	285,700	– 8,450
Great Southern pass (2,076 mls.)	42,303	27,857	+ 14,446	469,889	453,983	+ 15,906
,, ,, goods	36,785	43,345	– 6,560	636,322	683,013	– 46,691
,, ,, total	79,088	71,202	+ 7,886	1,106,211	1,136,996	– 30,785

* 43rd week (before pooling) Easter Monday, 1938

Fire Protection for Steel-Framed Buildings

The first public demonstration of a test designed to show the behaviour in fire of structural steelwork was given by Newalls Insulation Co. Ltd. at Barking Power Station, Creeksmouth, Barking, on April 22. A rectangular brick housing was erected, with walls 14 in. thick, and strengthened at the top with two sets of joists (6 in. × 3 in. × 12 lb.), each carrying a load of 2½ tons of bricks One set was unprotected, but the other was completely insulated with Newalls 1-in. thick moulded asbestos girder insulation, faced with refractory wash. Examples of uninsulated and insulated conduit for cables were also subjected to the fire test.

The fire was oil-fed, and temperatures were recorded in an insulated hut nearby. A time-recorder operated in view of the spectators. Bending of the unprotected girder, with distortion of the walls in which its ends were embedded, became apparent when the fire had been in progress for several minutes. At the end of 11¾ min. this girder collapsed, spilling its load of bricks into the flames beneath with a sullen patter of falling masonry and an eruption of thicker black smoke that momentarily brought to the scientific atmosphere of the experiment a realisation of the dangers to fire-fighters involved in practice by the collapse of steelwork. At this instant the thermocouple connected with the falling girder registered 570° C., whereas that recording the temperatures of the insulated girder showed only 93° C.

The fire was allowed to burn for about an hour, the insulated girder remaining unscathed throughout. During the test, visitors were able to inspect samples of Newalls asbestos moulded to fit various shapes and sizes of girder, and also special protective covers for cables. Newalls Insulation Co. Ltd. (a branch of Turner & Newall Limited) has its London office at Asbestos House, Southwark Street.

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices Apl. 27, 1938	Prices Rise, Fall
G.W.R.				
Cons. Ord. ...	67⅝	55¾	56	–1
5% Con. Prefce. ...	127	108	117½	—
5% Red.Pref.(1950)	113	109	109½	—
4% Deb.	113⅝	102½	110	—
4½% Deb.... ...	118	106	111½	—
4½% Deb.	124½	112	117½	—
5% Deb.	136½	122¾	129½	—
2½% Deb.... ...	76	64	67½	—
5% Rt. Charge ...	133 7/16	118	127½	—
5% Cons. Guar. ...	133¾	116½	127½	—
L.M.S.R.				
Ord.	36⅛	25⅜	21¾	–¼
4% Prefce. (1923)	82½	65¾	59½	–½
4% Prefce. ...	92½	77¾	76½	–½
5% Red.Pref.(1955)	107¾	102	102	—
4% Deb.	108	99¼	103½	–½
5% Red.Deb.(1952)	117½	111	113½	—
4% Guar. ...	104	95⅞	100½	—
L.N.E.R.				
5% Pref. Ord. ...	12½	6¾	6	–¼
Def. Ord.	6¼	3⅝	3⅛	–⅛
4% First Prefce.	79½	63	59	–1
4% Second Prefce.	31½	21	22	–½
5% Red.Pref.(1955)	101¼	89¾	89½	—
4% First Guar. ...	103	91⅞	96½	—
4% Second Guar.	97⅝	85½	87	+½
3% Deb.	84⅛	74	77½	—
4% Deb.	107¼	98½	102½	–½
5% Red.Deb.(1947)	113½	106½	109½	—
4½% Sinking Fund Red. Deb.	110 5/16	105½	108	—
SOUTHERN				
Pref. Ord.... ...	98⅝	83½	78	—
Def. Ord.	27⅞	16¾	20½	—
5% Pref.	126 1/16	105 13/16	114½	—
5% Red.Pref.(1964)	118	110¼	113½	—
5% Guar. Prefce.	133¾	116¾	126½	—
5% Red.Guar.Pref. (1957)	118½	111½	115	+1
4% Deb.	112	101¼	108½	+½
5% Deb.	135¾	123½	127½	—
4% Red. Deb. 1962–67	113	105	108½	—
BELFAST & C.D.				
Ord.	5	4	4½	—
FORTH BRIDGE				
4% Deb.	106	99½	100½	—
4% Guar. ...	105¾	99	100½	—
G. NORTHERN (IRELAND)				
Ord.	11	5	5 7/16	–1/16
G. SOUTHERN (IRELAND)				
Ord.	50	21½	20	—
Prefce.	61	34	27½	–2½
Guar.	94⅜	69½	52½	+1½
Deb.	95	82⅛	79¾	—
L.P.T.B.				
4½% "A" ...	123¾	110½	118½	—
5% "A" ...	135	121½	127½	—
4½% "T.F.A." ...	108¾	104	105½	—
5% "B" ...	125	114½	120½	—
"C"	99¾	75	78½	–1
MERSEY				
Ord.	42⅜	22	19	—
4% Perp. Deb. ...	103	96¾	100	—
3% Perp. Deb. ...	77⅝	74½	74½	—
3% Perp. Prefce.	68¾	61¼	63	—

CONTRACTS AND TENDERS

Orders for 87 L.M.S.R. Freight Vehicles

In connection with the L.M.S.R. 1938 wagon-renewal programme, orders have been placed with British manufacturers for a total of 87 new freight and service vehicles as follows :—

Metropolitan Cammell Carriage & Wagon Co. Ltd., Birmingham : Seventy-five 12-ton sleeper wagons.

Hurst, Nelson & Co. Ltd., Motherwell : Ten 35-ton bogie wagons.

Charles Roberts & Co., Horbury, Yorks : One 10-ton creosote tank wagon.

R. Y. Pickering Co. Co. Ltd., Wishaw : One ballast plough van.

H. W. Ward & Co. Ltd. has received an order from the Bengal North Western Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for one belt-driven combination turret lathe.

The Bombay, Baroda & Central India Railway Administration has placed orders, to the inspection of Messrs. Rendel, Palmer & Tritton, with F. E. Rowland & Co. Ltd., for one electrically-driven wet tool grinding machine for high-speed cutting alloys, and with the Vulcan Foundry Limited for 14 engine sets of coupling rods for XE class locomotives.

W. G. Bagnall Limited has received an order from the Bengal-Nagpur Railway for eight boilers for B class locomotives.

Robert Stephenson & Hawthorns Limited has received an order from the Bengal-Nagpur Railway for seven boilers for C class locomotives.

Accles & Pollock Limited has received orders from the Bengal-Nagpur Railway for two steel skeleton bodies for upper and intermediate class bogie carriages.

The American Car & Foundry Export Co. Ltd. has received an order from the Bengal-Nagpur Railway for 1,000 chilled cast-iron wheels.

La Brugeoise et Nicaise & Delcuve S.A. has received an order from the Paraguay Central Railway for 40 wagon underframes.

The General Electric Co. Ltd. has received contracts from the L.N.E.R. and from the L.M.S.R., Northern Counties Committee, for the supply of Osram lamps.

W. & T. Avery Limited has received orders from the Indian Stores Department for ten 10-ton capacity portable weighing machines.

Parry's Engineering Limited has received orders from the Controller of Stores, North Western Railway, Lahore, for 44 manually-operated mobile gang trolleys with Hyatt roller bearings.

Ateliers de la Dyle S.A. has received an order from the Siamese State Railways for 20 carriage underframes and bogies to be supplied to the inspection of Messrs. Sandberg.

The Siamese State Railways Administration has placed the following orders to the inspection of Messrs. Sandberg :—

A.B.C. Coupler & Engineering Co. Ltd. : 24 buffers.

Mitteldeutsche Stahlwerke : 50 locomotive tyres.

Albert Hahn : 400 boiler tubes.

Schmidtsche Heiffdampf : 380 superheater elements.

Buchumer-Verein A.G. : 400 bearing springs.

S.A. John Cockerill : 120 spring top plates.

Taylor Brothers & Co. Ltd. has received an order from the Entre Rios Railways for 38 steel axles and 118 steel tyres for locomotives, carriages, and wagons.

Ransomes & Rapier Limited has received an order from the Central Uruguay Railway for one 3½–5 ton diesel-electric super mobile crane.

James Archdale & Co. Ltd. has received an order from the Bengal-Nagpur Railway Administration for one piston valve liner port milling attachment.

The Hunslet Engine Co. Ltd. has received orders from the Jodhpur Railway Administration, to the inspection of Messrs. Rendel, Palmer & Tritton, for one superheated boiler for O-class locomotive and two superheated boilers for P and M-class locomotives.

Stewarts and Lloyds Limited has received an order from the Central Argentine Railway for 690 galvanised solid drawn acid resisting steel superheater smoke-tubes.

B. R. Herman & Mohatta Limited has received an order from the Indian Stores Department for 150 pairs of broad-gauge wheels and axles for light trolleys at a total price of Rs. 11,700 delivered free Storespura.

Etab. Duchesne & Cie. has received an order from the Egyptian State Railways Administration for weigh-bridges (Ref. No. E.S.R. 55.283, total cost £500, delivery f.o.b. Marseilles or Antwerp).

Howell & Co. Ltd. has received an order from the Central Argentine Railway for 5,500 steel boiler tubes.

The Crown Agents for the Colonies have recently placed the following orders :—

Power-Samas Accounting Machines Limited : Accounting machine equipment.

Chloride Electrical Storage Co. Ltd. : Battery material.

Le Carbone Limited : Battery materials.

Nuts & Bolts (Darlaston) Limited : Bolts.

Brown Lenox & Co. Ltd. : Cable.

British Insulated Cables Limited : Cable.

C. Richards & Sons Limited : Clips.

H. Morris Limited : Diesel-electric mobile crane.

Taylor & Hubbard Limited : Electric cranes.

General Electric Co. Ltd. : Electrical materials ; fans and regulators ; telephone equipment.

English Electric Co. Ltd. : Engine spares.

Turners Asbestos Cement Company : Everite pipes.

J. Cranmer & Co. : Expanded metal.

Wolverhamptton Corrugaed Iron Co. Ltd. : Galvanised corrugated steel sheets.

Ruston & Hornsby Limited : Generating plant.

Brown, Bayleys Steel Works Limited has received an order from the Leopoldina Railway for 120 steel axles for carriages and wagons.

R. Wright & Partners Limited has received orders from the Indian Stores Department for a total of 315 steel locomotive tyres.

Saxby & Farmer (India) Limited has received orders from the Indian Stores Department for 33,000 ft. of tubular point rodding at a total price of Rs. 17,016 delivered free Storespura.

S.A. des Usines et Boulonneries de Mariemont has received an order from the Buenos Ayres Great Southern Railway for 100,000 mild steel dog-spikes for 85-lb. rails.

Locomotive Boilers required for India

The North Western Railway, Lahore, is calling for tenders, to be presented in India by May 30, for the supply of 32 locomotive boilers.

All-Electric Equipment for L.N.E.R. Goods Depot, Leeds

The L.N.E.R. is to replace the whole of the mechanical equipment at Wellington Street goods depot, Leeds, by electrically-operated appliances. The existing cranes, capstans, and hoists are operated by hydraulic power. The new installation will consist of 11 electric capstans, five electric warehouse hoists, one 2½-ton fixed electric jib crane, and one six-ton mobile petrol-electric crane which will be available for use in any part of the warehouse yard.

Tenders are invited, on a rupee basis, by the Controller of Stores, North Western Railway, Lahore, receivable by May 23, for the supply of 400 pressed steel drawbar cradles.

Tenders are invited by the Chief Controller of Stores, Indian Stores Department (Engineering Section), receivable by May 9, for the supply of 58,000 mild steel non-reversible clips for steel sleepers, required for the Jodhpur Railway.

Tenders are invited by the Chief Controller of Stores, Indian Stores Department (Hardware Section), New Delhi, receivable by May 9, for the supply of bolts and nuts required for steel sleepers, for the Jodhpur Railway.

The Chief Controller of Stores, Indian Stores Department (Electrical Section), invites tenders, receivable by May 19, for the supply of a total of approximately 2,900 yards of inter-coach five-core, flexible cable, required for the Eastern Bengal, East Indian, Great Indian Peninsula, and North Western railways during the period September 16, 1938, and September 15, 1939.

The Royal Hungarian State Iron, Steel & Machine Works' order, placed by the Great Indian Peninsula Railway through Shaw Wallace & Co., should have been described on this page last week as for five superheated coal-burning locomotive boilers, and not locomotives as there stated in error.

OFFICIAL NOTICES

Crown Agents for the Colonies

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are invited for the following posts :—

M/5555. ASSISTANT ENGINEER required for the Sierra Leone Government Railway for one tour of 12-24 months. Salary £840 a year. Free quarters and passages and liberal leave on full salary. Candidates not over 50 years of age, must have had considerable experience in steelwork erection, and should preferably have had charge of railway bridge construction under traffic.

M/5852. ASSISTANT LOCOMOTIVE SUPERINTENDENT required for Tanganyika Government Railway for one tour of from 20-30 months with possible permanency. Salary £480—£20—£600—£30—£720 a year. Free quarters and passages and liberal leave on full salary. Candidates, age 22-28, must hold a University Engineering Degree or be Associate Member of the Institution of Mechanical Engineers. They should have served an apprenticeship in the locomotive department of a British railway or with a firm of Locomotive Builders and have had Running experience.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting the reference number against the appointment for which application is made.

South Indian Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of :—

COPPER PLATES.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company Limited, marked "Tender for Copper Plates," with the name of the firm tendering, must be left with the undersigned not later than 10 a.m. on Friday, the 13th May, 1938.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the Specification.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, Westminster, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
27th April, 1938.

Bengal-Nagpur Railway Company Limited

THE Directors are prepared to receive Tenders for :—

ENGINE WHEELS AND AXLES.

Specification and Form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after 28th April, 1938.

A fee of 10s. will be charged for each copy of the Specification, which is *NOT* returnable.

Tenders must be submitted not later than Noon on Friday, 13th May, 1938.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

OFFICIAL ADVERTISEMENTS

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

WHARTON SHIELD AMBULANCE COMPETITION, L.N.E.R.—Ambulance teams representing the six districts of the North Eastern Area Centre of the St. John Ambulance Association, competed in the final competition for the Wharton Shield at Darlington on April 9. The competition was judged by Dr. F. E. Bendix, of Ilford. The shield was won by Newcastle (Tyne Dock), with 274 points out of 400. Darlington (Engineers) was second, with 205½ points. The Wharton Shield and medals were presented to the Tyne Dock team, and the Hornsby Ambulance Challenge Cup to the Darlington (Engineers) team, by Mr. C. M. Jenkin Jones, Divisional General Manager, North Eastern Area, who is President of the Ambulance Centre. Among those present were :—

Messrs. G. Sowerby, Estate Surveyor, York ; A. A. Ryan, Hotels Superintendent, York ; T. B. Hare, District Superintendent, Darlington ; K. P. Walker, District Goods and Dock Manager, West Hartlepool ; L. Sproat, District Superintendent, York ; J. H. McIlvenna, District Engineer, Darlington ; E. D. Trask, District Locomotive Superintendent, York.

G.W.R. AMBULANCE PRESENTATION AT WORCESTER.—Mr. F. R. Potter, Superintendent of the Line, G.W.R., presented the annual examination awards and first aid challenge trophies and prizes to members of the G.W.R. Worcester Division, at the Guildhall, Worcester, on April 6. He was supported by the Mayor of Worcester, who was accompanied by the Mayoress ; and in addition to Mr. J. Potter, Divisional Superintendent, there were also present two previous Worcester Divisional Superintendents, Messrs. R. W. Higgins and H. J. Peacock. Among others present were Mr. W. E. Hart, Divisional Superintendent, Birmingham; Mr. H. S. B. Whitley, Divisional Engineer, Wolverhampton ; and local officers of the company. Mr. J. A. Warren-King, District Goods Manager, Worcester, presided and paid tribute to the encouragement and guidance which the ambulance movement at Worcester received from the medical profession. He commented on the fact that 140 ambulance members in the division held the company's gold efficiency awards for long service. Opportunity was taken of the occasion to mark the time and trouble which Mr. Peacock had devoted to the movement during his term of office as Divisional Superintendent by the presentation to him of a cigarette box and table lighter at the hands of Mr. W. J. Waite, Divisional Ambulance Secretary ; and in reply Mr. Peacock paid tribute not only to the sacrifice of leisure made by the staff in order to maintain first aid efficiency, but also to the co-operation of their wives.

G.W.R. AMBULANCE PRESENTATION AT SWINDON.—The annual smoking concert and distribution of awards to members of the Swindon ambulance classes took place at the Baths Hall on April 1, when Mr. J. Auld, Principal Assistant to the Chief Mechanical Engineer, presided, and was supported by Mr. F. W. Hawksworth, Assistant to the Chief Mechanical Engineer ; Mr. G. F. Boxall, Stores Superintendent ; Mr. W. W. Wakefield, M.P. ; Mr. F. C. Hall, Locomtive Running Superintendent ; and Dr. A. W. Bennett. Opportunity was taken to present to Mr. L. G. Bretsch, Divisional Ambulance Secretary, the certificate of Honorary Serving Brother of the Order of St. John. The awards, which numbered upwards of 470, and included 19 gold medals and bars for long service efficiency, were presented by Dr. Dunstan Brewer. Mr. Auld congratulated the Swindon classes, including the Works class and station and women's classes, on having achieved a record session, and commented on the fact that 70 of their members held the company's gold efficiency awards.

Parliamentary Notes

L.M.S.R. Bill

The London Midland & Scottish Railway Bill was read the third time and passed in the House of Commons on Tuesday, April 26.

Forthcoming Meetings

May 3 (*Tues.*).—**Compagnie Internationale des Wagons-Lits et des Grands Express Européens** (Ordinary General), 53, Boulevard Clovis, Brussels, at 2 p.m.

May 4 (*Wed.*).—**Canadian Pacific Railway Company** (Annual General), Principal Office of the Company, Montreal, at noon.

May 27 (*Fri.*).—**Société Nationale des Chemins de fer Belges** (Ordinary General), 34, Rue de Stassart, Brussels, at 3 p.m.

Forthcoming Events

Apr. 29 (*Fri.*).—Railway Students' Association (Edinburgh), 7.30 p.m. Annual General Meeting.

May 2 (*Mon.*).—Society of Engineers, at Geological Society, Burlington House, Piccadilly, London, W.1, 6 p.m. "Modern Welding Practice," by Dr. T. Scott Glover.

May 3 (*Tues.*).—Institute of Transport (Leeds Graduate), at City Transport Department, 7 p.m. Annual General Meeting.

Mansion House Association on Transport, at Trocadero Restaurant, Piccadilly Circus, London, W.1, 12.45 for 1 p.m. Luncheon and Annual Meeting.

May 4 (*Wed.*).—Institute of Metals, at Inst. of Mechanical Engineers, Storey's Gate, London, S.W.1, 8 p.m. Annual May Lecture : "Plastic Strain in Metals," by Prof. G. Taylor.

May 5 (*Thurs.*).—Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "London to Bristol—A G.W.R. Monopoly," by Canon Fellows, M.A.

May 13 (*Fri.*).—Past and Present Crewe Pupils and Premiums Dinner, at the Trocadero Restaurant, Piccadilly, London, W.1, 7.15 for 7.45 p.m.

Railway Share Market

Although the Budget was more drastic than had been generally anticipated, the stock and share markets have shown a much better trend than might have been expected. On Wednesday morning values in most sections of the Stock Exchange were lowered by dealers as a precautionary measure, awaiting the reactions to the Budget proposals, but subsequently buyers were in evidence and prices recovered strongly.

Home railway stocks were a relatively steady feature, although they tended to lower prices following publication of the past week's traffics. The latter were disappointing, with the exception of those of the Southern, which is the only railway to record an increase in receipts for the Easter fortnight, compared with the corresponding period of last year. Sentiment was assisted to some extent by the hope that the higher petrol tax may divert traffic from the roads to the railways.

Great Western ordinary stock was lower at **56**, but continued to show a fair amount of activity, as did L.M.S.R. ordinary, although the latter at **21¾** is also lower on balance. The expected improvement in Anglo-Eire trade should, of course, prove a favourable point for the two last named railways. L.M.S.R. 4 per cent. preference at **77** and the 4 per cent. 1923 preference stock at **60** were relatively steady features. L.N.E.R. first preference at **59½** and the second preference at **22½** did not keep best prices touched this week, but very little selling was reported. Southern preferred was active, and business recorded up to **78**, while the deferred attracted a good deal of attention around **20½**, the disposition in the market being to take a hopeful view of the traffic outlook, particularly as the railway usually has its best period in the second half of the year. Guaranteed and debenture stocks were well maintained despite the rather easier tendency in evidence in British Government securities. London Transport "C" stock transferred between **77½** and **80** on Wednesday, the higher petrol tax having led to less encouraging views in regard to dividend prospects.

Foreign railway stocks have been a better market. San Paulo was fairly steady following the statements at the meeting, and Leopoldina debentures were in some request, sentiment in regard to Brazilian securities having improved. The indications that Brazil is willing to consider a new settlement in regard to its external debt service suggests that the authorities do not expect deterioration in the country's economic position. Argentine railway stocks were inclined to improve, and apart from the B.A. Gt. Southern, Central Argentine and B.A. Western ordinary, buyers have been in evidence for B.A. and Pacific debenture stocks on confirmation of the cut in wage rates. Some demand was also reported for Argentine Gt. Western debentures. Canadian Pacific showed activity around **6⅜**.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937-38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1937	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: Apr. 27, 1938	Yield % (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	24 4.38	19,440	+ 2,620	17	278,420	292,100	– 13,680	Ord. Stk.	29	10¼	10	Nil
	Argentine North Eastern ..	753	23 4.38	9,733	+ 992	43	387,556	372,101	+ 15,455	,,	19¼	6	3	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	93½	60	75	5
	Bolivar	174	Mar., 1938	4,800	– 1,300	13	11,900	17,200	– 5,300	6 p.c. Deb.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	17	9	5½	9116
	Buenos Ayres & Pacific ..	2,806	23.4.38	95,906	– 27,853	43	3,798,888	4,031,990	– 233,102	Ord. Stk.	17⅛	5½	5	Nil
	Buenos Ayres Central ..	190	9.4.38	$83,100	– $44,600	41	$4,797,400	$5,778,200	– $980,800	Mt. Deb.	41½	18	11½	Nil
	Buenos Ayres Gt. Southern	5,084	23 4.38	146,960	– 10,422	43	6,488,212	6,506,532	– 18,320	Ord. Stk.	33⅝	13½	12½	Nil
	Buenos Ayres Western ..	1,930	23 4.38	48,263	– 18,921	43	1,951,737	2,139,160	– 187,423	,,	31⅝	11¼	9	Nil
	Central Argentine	3,700	23.4.38	106,545	– 58,464	43	5,224,951	6,624,366	– 1,399,415	,,	34¼	10⅝	10	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	20½	4½	4	Nil
	Cent. Uruguay of M. Video	980	16.4.38	20,711	+ 88	42	757,066	739,877	+ 17,189	Ord. Stk.	67/32	2	2½	Nil
	Cordoba Central	1,218	—	—	—	—	—	—	—	Ord. Inc.	6¼	1½	1½	Nil
	Costa Rica	188	Feb., 1938	18,767	+ 1,741	35	197,323	142,134	+ 55,189	Stk.	38	27	27½	7¼
	Dorada	70	Mar., 1938	14,400	– 2,500	13	46,800	48,000	– 1,200	1 Mt. Db.	107	106	106	5⅝
	Entre Rios	810	23 4.38	15,347	+ 4,193	43	613,584	553,726	+ 59,858	Ord. Stk.	19716	6	5	Nil
	Great Western of Brazil ..	1,092	23 4.38	5,400	– 800	17	130,600	135,600	– 5,000	Ord. Sh.	5/4	1/8	1/4	Nil
	International of Cl. Amer..	794	Feb., 1938	$477,297	– $42,015	9	$964,439	$1,033,251	– $68,812	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	2/-	1/-	1/2	Nil
	La Guaira & Caracas ..	22‖	Mar., 1938	5,095	– 585	13	14,675	16,875	– 2,200	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	23.4.38	17,552	– 2,606	17	307,886	365,836	– 57,950	Ord. Stk.	9¼	3	2½	Nil
	Mexican	483	21.4.38	$308,500	+ $47,300	16	$4,996,200	$4,981,300	+ $14,900	,,	1½	1/4	5/16	Nil
	Midland of Uruguay ..	319	Mar., 1938	10,313	+ 777	40	83,213	79,010	+ 7,203	,,	1⅞	1/2	1/2	Nil
	Nitrate	384	15.4.38	5,037	– 1,917	15	53,035	54,287	– 1,252	Ord. Sh.	31/16	2	1/4	Nil
	Paraguay Central	274	23.4.38	$4,200,000	+ $133,000	43	$132,916,000	$121,343,000	+ $11,573,000	Pr. Li. Stk.	84	79¼	72½	8¼
	Peruvian Corporation ..	1,059	Mar., 1938	80,434	– 5,486	39	740,756	730,817	+ 9,949	Pref.	14⅝	4½	3½	Nil
	Salvador	100	16.4.38	¢21,500	– ¢16,000	42	¢856,725	¢1,007,008	– ¢150,283	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153§	17.4.38	26,500	– 4,244	16	450,635	479,669	– 29,034	Ord. Stk.	98½	56	43⅝	9516
	Taltal	160	Mar., 1938	1,285	– 2,595	39	31,955	31,810	+ 145	Ord. Sh.	1716	1116	3/4	13516
	United of Havana	1,353	23.4.38	23,303	– 18,097	43	1,081,407	1,165,368	– 83,961	Ord. Stk.	55⅛	31/32	2½	Nil
	Uruguay Northern	73	Mar., 1938	979	+ 179	40	8,430	9,292	– 862	Deb. Stk.	10	2	2	Nil
Canada	Canadian National	23,781	21.4.38	621,879	– 153,729	16	10,161,548	11,339,989	– 1,178,441	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	77	62½	62½	6⅜
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	101⅞	94½	99½	4
	Canadian Pacific	17,186	21.4.38	463,200	– 58,800	16	7,484,400	7,942,000	– 457,600	Ord. Stk.	18	7¼	6½	Nil
India†	Assam Bengal	1,329	31.3.38	43,177	+ 3,014	52	1,397,290	1,357,316	+ 39,974	Ord. Stk.	86	73½	79	3516
	Barsi Light	202	10.4.38	6,457	+ 3,195	2	6,457	3,262	+ 3,195	Ord. Sh.	66½	46	58§	85⅞
	Bengal & North Western ..	2,107	10.4.38	89,709	+ 277	2	89,709	89,432	+ 277	Ord. Stk.	317	301	297½	6
	Bengal Dooars & Extension	161	10.4.38	3,695	+ 427	2	3,695	3,268	+ 427	,,	100	84	85½	7
	Bengal-Nagpur	3,268	10.4.38	198,525	– 5,280	2	198,525	203,805	– 5,280	,,	101	89	91½	4⅜
	Bombay, Baroda & Cl. India	3,072	20.4.38	287,775	– 3,825	3	566,250	570,900	– 4,650	,,	113	110½	110½	5716
	Madras & Southern Mahratta	2,967	31.3.38	200,475	+ 20,922	52	5,595,583	5,533,484	+ 62,099	,,	110	105	105½	8116
	Rohilkund & Kumaon ..	571	10.4.38	18,561	– 2,451	2	18,561	21,012	– 2,451	,,	314	302	303½	5516
	South Indian	2,531§	31.3.38	126,658	– 10,408	52	4,189,261	4,032,159	+ 157,102	,,	103½	99½	102½	45⅛
Various	Beira-Umtali	204	Feb., 1938	87,194	+ 23,004	22	443,755	332,996	+ 110,759	—	—	—	—	—
	Egyptian Delta	620	31.3.38	6,545	+ 439	52	262,710	253,028	+ 9,682	Prf. Sh.	31/-	3/4	3/4	Nil
	Kenya & Uganda	1,625	Mar., 1938	279,680	– 4,212	13	802,157	852,979	– 50,822	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb	48⅛	43½	46½	7½
	Midland of W. Australia ..	277	Feb., 1938	15,062	+ 3,739	35	113,039	106,190	+ 6,849	Inc. Deb	98	93½	93½	4¼
	Nigerian	1,900	19.3.38	37,874	– 35,977	51	2,742,256	2,564,196	+ 178,060	—	—	—	—	—
	Rhodesia	2,442	Feb., 1938	391,093	+ 56,372	22	2,101,534	1,699,975	+ 401,559	—	—	—	—	—
	South Africa	13,263	16.4.38	622,714	+ 4,861	3	1,457,998	1,443,272	+ 14,726	—	—	—	—	—
	Victoria	4,774	Jan., 1938	887,042	– 77,664	31	5,598,386	5,850,533	– 252,167	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee § ex dividend

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements are based on the current rates of exchange and not on the par value

Electric Railway Traction

The German Electrified System

AT the end of 1937 the electrified route of the German State Railway totalled 1,421 miles (2,288 km.) of which 190 miles was accounted for by the urban and suburban lines in Berlin and Hamburg. The track length electrified is approximately 3,730 miles, and of the electrified route one per cent. is multiple track, 73 per cent. double track, and 26 per cent. single track. The suburban lines in Berlin are low voltage d.c., and the remainder of the electrification is single-phase. Energy is supplied through high tension transmission networks with a length of about 785 miles, and the yearly energy consumption is 860 million kWh., of which 400 million kWh. is accounted for by the suburban lines. These figures are equivalent to 250,000 kWh. per km. of main line a year and 1,230,000 kWh. per km. of suburban line. The specific energy consumption measured at the vehicle current collector averages 23·5 watt-hr. per tonne-km. on the main lines and 50·1 watt-hr. per tonne-km. for suburban trains. Measured at the h.t. busbars the respective consumptions are 26 and 57·1 watt-hr. The electrified system is worked by 543 electric locomotives, 1,123 motor-coaches, and 1,319 trailers and driving trailers. Suburban services claim 966 motor-coaches and 983 trailers from the foregoing totals. Electrically-hauled train-km. average 29 million a year, and the electric locomotive-km. 33 million. Mutiple-unit trains and motor-coach hauled trains make a yearly kilometrage of 40 million, equivalent to 8,000 million motor-coach tonne-km. The capital value of the fixed equipment of the electrified lines approaches 250 million RM., and of the electric locomotives, motor-coaches, and trailers 370 million RM. Lines now under conversion are the Nuremberg—Halle—Leipzig route (218 miles) and the Stuttgart—Zuffenhausen section (17 miles).

Points in Electric Locomotive Design

NUMEROUS points of technical interest were raised during a lengthy discussion of Mr. C. E. Fairburn's paper on electric locomotive design at the Institution of Electrical Engineers on April 7. Not a little of the discussion was taken up by the subject of motors and their drives. Mr. G. H. Fletcher, of Metro-Vick, considered that as far as d.c. traction motors were concerned it was perhaps somewhat unfair to talk in terms of weight per h.p. as indicative of the progress during the last ten years, because the use of field regulation has increased and—particularly if this is used to a high degree—it increases the weight of the motor. A better comparison was to be found in the weight of the armature, and on this basis there has been a 12 to 18 per cent. increase in the output per unit of weight, and there has also been an 8 to 12 per cent. increment in the armature speed during the last 10 years. Important from the first cost point of view is the temperature rise permitted in the motor; 105° C. is still a standard, but rises of 130° for the armature and 120° for the field have been suggested at the International Electrical Congress, and Mr. Fletcher said that he himself had experimented with up to 200° without deterioration of the insulation. Data supplied by American railroads show that temperature rises of 140° to 180° have been in use for years. Mr. Schroeder, dealing with individual axle drives, recalled that the Heilmann thermo-electric locomotive of 40 years ago had a type of drive very similar to the present Kleinow arrangement, and outlined a new form of disc drive which is being evolved by Brown Boveri, and which is without links, pins, or rubbing surfaces. This system is to be tried on a 2-C-1 locomotive of the Swiss Federal Railways. Individual axle drives were commented on by other speakers. Mr. Calverley (English Electric), for example, said that whereas he had found in France that individual axle drives with helical springs could run for 240,000 km. (150,000 miles) with the renewal, perhaps, of only three rubbing plates in the wheels, similar drives, but with laminated springs, in Italy ran only 40,000 to 50,000 km. (25,000 to 31,000 miles) before the spring plates had to be renewed. Considerable discussion arose as to the merits and demerits of nose-suspended motors and double-bogie locomotives. Mr. H. C. McClean (Crompton, Parkinson) remarked that 80 per cent. of the d.c. motors and 14 per cent. of the a.c. motors listed in Mr. Fairburn's tables had nose-suspended motors. Dr. F. T. Barwell asked why more use was not made of vertical motors, and instanced the types on the Austrian Federal Railways. But the truth is that the "1570" and "1670" classes on the Austrian Federal Railways have given an axle life of only three to four years, and for the latest units being built for the Vienna—Salzburg line the vertical motor has been given up for this reason. Many speakers believed that the Bo-Bo locomotive—possibly with hydraulic shock absorbers—could be run safely up to fairly high speeds, say 65 to 75 m.p.h., and examples of such speeds were quoted, but no one drew attention to the fact that apparently the Bo-Bo locomotive has no inherent stability when running on the track. Mr. Croft (General Electric) believed that the express electric locomotive of the future would be of the bogie type with a sufficient wheelbase on the bogie, and if one considers the 2-Co+Co-2 locomotives of the Pennsylvania Railroad, there is little need to disagree with this contention. Interesting particulars as to the tyre wear on the G.I.P.R. were given by Mr. C. C. Inglis. The 2-Co-1 Metro-Vick locomotives, over a mileage of 1,700,000 ran up to 280,000 miles between driving tyre returnings, and the tread wear was the deciding factor. The Java truck wheels went 140,000 miles, and flange wear was the deciding factor. The mileage of the C+C freight locomotives with rod drive was 150,000 miles between returnings, which are necessitated by flange wear. A good deal of reference was made to the industrial-frequency single-phase line in the Black Forest, and the concensus of opinion was that, at least as regards rectifier locomotives, the future could not be viewed with optimism. Mr. Fletcher said that great difficulty had been experienced, and Mr. Schroeder intimated that his firm (Brown Boveri) did not believe the Höllental system would come into general use. On the other hand, Dr. Wechmann, of the Reichsbahn, has since said that these locomotives "have been in service one and a half years and have been approved in spite of the hard service."

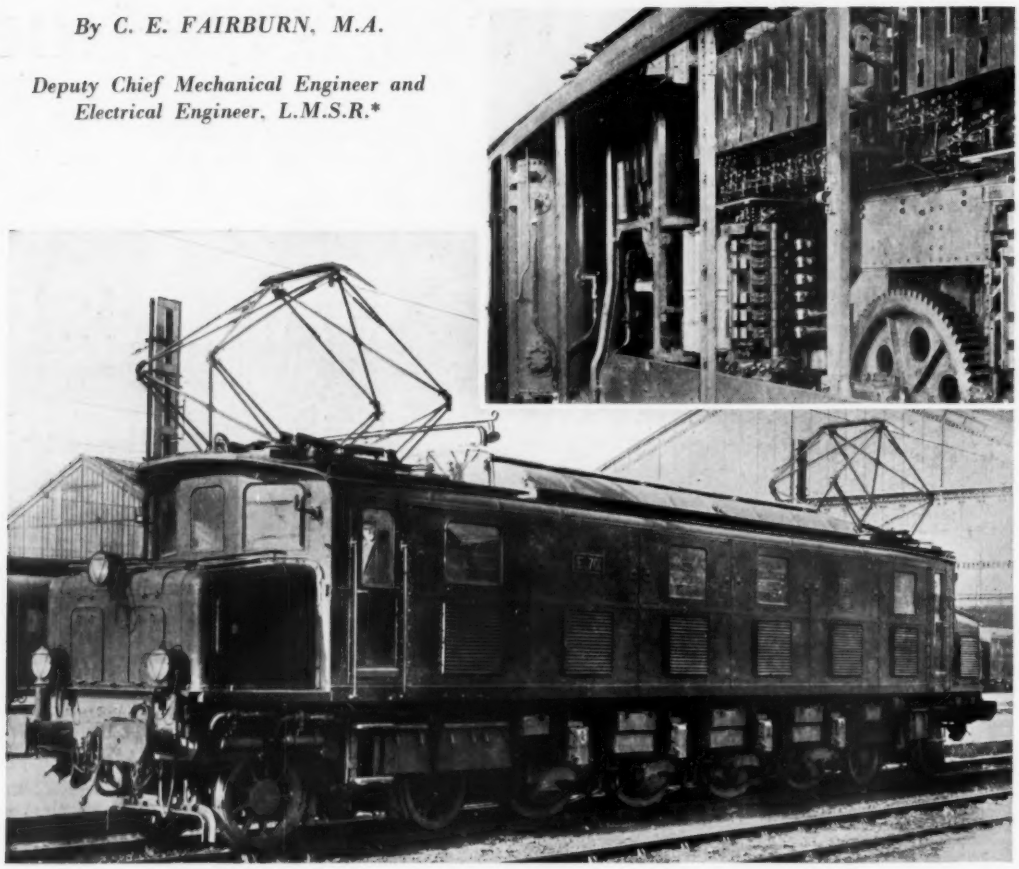
XUM

ELECTRIC LOCOMOTIVE DESIGN

The trend of development of main-line units during the last ten years

By C. E. FAIRBURN, M.A.

*Deputy Chief Mechanical Engineer and Electrical Engineer, L.M.S.R.**



4,000 h.p. d.c. electric locomotive, ex P.O.-Midi Railway, and arrangement of control gear in a central compartment

IN the last few years there has been a demand for electric and steam locomotives of greater power, due as much to increased operating speeds as to increased train weights. There can be no doubt that in the future there will be still further increases in speeds, and probably there will be a desire to increase train weights at the same time. Limitations of loading gauge restrict the power of the steam locomotive to a much greater degree than the electric locomotive where, if necessary, two or more units can be coupled together and worked by a single crew, thus becoming, so far as operation is concerned, a single unit. This method is in use on a number of electrified lines and it would appear to provide a complete solution of all demands for greater power, but, in fact, under average conditions it is expensive in first cost and in maintenance and the present tendency, whenever possible, is to use larger single units.

Mechanical Design

The outstanding feature of recent design is the adoption of individual axle drive instead of side-rod drive. Apart from shunting locomotives, few new designs incorporating side rods have appeared for some years, and in the few cases where side-rod locomotives are still being built for main-line service the course appears to be adopted either for standardisation or to meet some special condition.

Today there are in use various types of individual axle drive which can be used with equal facility on either alternating or direct-current locomotives, and there appear to be only four cases where a rod drive has been retained or introduced during the last 10 years for main-line service. On the Swedish State Railways the first main-line locomotives were of this type and it is still favoured there, although double-bogie units with nose-suspended motors are in use on branch lines. Tests made in Sweden between these two types and a double-bogie unit with quill drive showed that there is nothing to choose between them as far as effect on the track is concerned, but the rod-drive unit gave much better adhesion.

Large locomotives, whether of the rigid frame or of the articulated type, are generally fitted with frame-mounted motors, but there are some instances where nose-suspended motors have been used, just as there are cases of double-bogie units with the motors mounted on the bogie frames. The general aim in the design of these larger locomotives is to reduce the dead weight on the driving axles as much as possible, but the success of high-speed diesel-electric locomotives in the United States is

* In a paper read before the Institution of Electrical Engineers, in London, April 7.

making designers wonder whether the advantages of the frame-mounted motor have not been over-estimated in comparison with the much cheaper and simpler nose-suspended motor.

In general, the aim of the designer in using individual axle drive has been to secure a fairly high centre of gravity with the lowest possible unsprung weight on the driving axles, but recently there has been some tendency to reduce the actual maximum axle load without necessarily keeping the unsprung weight low or maintaining a high centre of gravity. This last observation may not appear to be supported by recent designs, and to some extent it is an anticipation. There seems to be a growing opinion that a design can easily incorporate too many springs which, more especially on direct-current locomotives, give in the end a balance on the debit side. It must be remembered that the springs of the drive are, in effect, in parallel with those carrying the weight of the locomotive, and also that more particularly on the higher-speed units, there may be speeds at which the natural period of the drive will be the same as that of some parts of the locomotive on the track. Before a spring drive can be adopted a careful analysis of the running conditions must be made.

The success of the individual axle drive depended in some measure on the development of gears small enough to fit into the spaces available, and yet of sufficient durability to avoid high maintenance costs. An examination of designs of recent years reveals no appreciable tendency towards an increase in the horsepower handled per set of gears, but the increased motor speeds and higher train speeds now common involve a corresponding increase in the running speeds of the gears. Metallurgical improvements have been used to secure longer life rather than to increase the tooth loading.

When twin gears are used to handle powers considered too great for a single set, the question of balancing the load between the two sets requires attention. If cushion-type gears are fitted no problem arises, but an alternative arrangement, applicable more particularly to quill drives, is to use skew gears so that the mesh adjusts itself by an axial movement of the armature and pinions in relation to the driven gears.

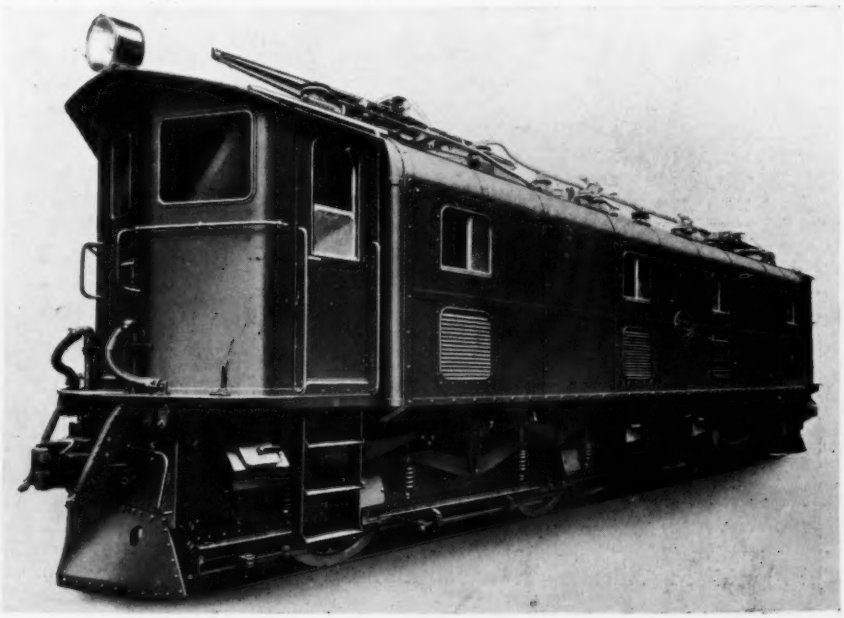
Nose-suspended motors with a single gear drive are usually fitted with solid gears, but there are instances where cushion gears have been fitted, an interesting case being the South African locomotives where the original 95 units had solid gears but the new units have a cushion type. Helical teeth are not widely used, the most common case being that mentioned above, where twin gears are employed and where the axial thrusts cancel out, thus avoiding the need for special thrust bearings.

On double-bogie locomotives the bogie centres are usually of the spherical type with the bowl portion mounted on the bogie, but recently some locomotives have been built with flat centres. A few years ago the Midi Railway, with a view to obtaining better riding qualities, introduced some locomotives with the centres inverted, *i.e.*, with the bowl portion attached to the body. The effect of this change is to increase the natural period of oscillation of the body. In the normal arrangement the point about which the body oscillates—the centre of generation of the seating—is close to its centre of gravity, but in this alternative design it is below the seating some distance from the centre of gravity, thus giving a longer period of oscillation. With the inverted seating the body has no inherent stability, and spring-loaded side bearing plates are needed to keep it in position.

When applied to the double-bogie locomotive the advantage of articulation is that the drawbar pull and buffing shocks are not borne by the frame, which can then be of relatively light construction. There seems also to be some evidence that riding qualities are improved, and there has been a general tendency in favour of articulation on such units; on those with more than two axles per bogie it is almost universal. It has the disadvantage that the minimum radius of curvature through which the locomotive can run is restricted.

Most railways have always fitted air-operated brakes to electric locomotives, irrespective of whether the train brakes were air or vacuum-operated. Only one railway with a considerable number of locomotives—the Spanish Northern—has retained vacuum brakes on its most recent units.

In view of the maximum brake pressures (up to 300 per cent.) which are now being employed on high-speed diesel trains in regular service in America, it appears that the pressures on electric locomotives could in many cases be increased with advantage, and it is interesting to note



One of the numerous 1,500 volts d.c. Metro-Vick standard 1,200 h.p. locomotives for the 3 ft. 6 in. gauge electrified lines of the South African Railways. The weight is 65½ tons and the one-hour output, 21,200 lb. tractive effort at 21½ m.p.h.

that this has been done on the latest German express locomotives, the braking system of which is novel in a number of respects. On these locomotives clasp brakes are fitted to all wheels, those on the driving wheels being operated by eight cylinders, coupled in four pairs, while each bogie carries two coupled cylinders. The air pressure in these cylinders is controlled by a centrifugal governor which, in conjunction with a regulator valve, limits the pressure to 50 lb. per sq. in. at speeds below 34 m.p.h., while above that speed it can rise to 118 lb. per sq. in. On the leading bogie only one of the two air cylinders is used, and air at the reduced pressure only is admitted at all speeds, giving a maximum braking pressure of 41 per cent. On the trailing bogie both cylinders are used. The driving-wheel pressures are 72 and 180 per cent. and the trailing bogie pressures 63 and 153 per cent. at low and high speeds respectively, giving total braking values of 66 and 158 per cent. About half the locomotives designed during recent years have roller bearings on the motor armatures, but in only a few instances are they fitted to the axleboxes also, and in comparison with motor-coach practice the rate of progress in their application may seem slow. The facilities for observing and oiling bearings are much better on locomotives than on motor-coaches, and frequent inspections have to be carried out in any case, so there is little saving in labour. There is, however, usually some saving in oil and grease.

Welding is now tending to displace riveting in the construction of electric locomotive frames, and much of the work of shaping the components can be done by gas cutting. In many instances the substitution of welding for riveting results in a stronger unit of lighter weight. The latest express units of the German State Railway present a good example of the completely welded frame.

Welding has been applied with success to the construction of locomotive bodies, which are now almost universally of steel. One notable exception is found on the Pennsylvania Class P5A locomotives where aluminium panelling, &c., was used as a means of weight reduction.

Although it may appear a somewhat trivial matter, the provision of speed indicators is important from the operating point of view. On steam locomotives it has not hitherto been usual to provide indicators, but fortunately on electric locomotives it is almost standard practice to fit them. In the author's opinion this is not merely desirable but necessary, as when the driver is forced to estimate his speed the civil engineer in fixing speed restrictions must allow a considerable margin for errors, but when the driver knows the speed within narrow limits no large margin is necessary and the average running speed can be improved with complete safety. In some cases recording speed indicators are fitted, and this practice has much to commend it.

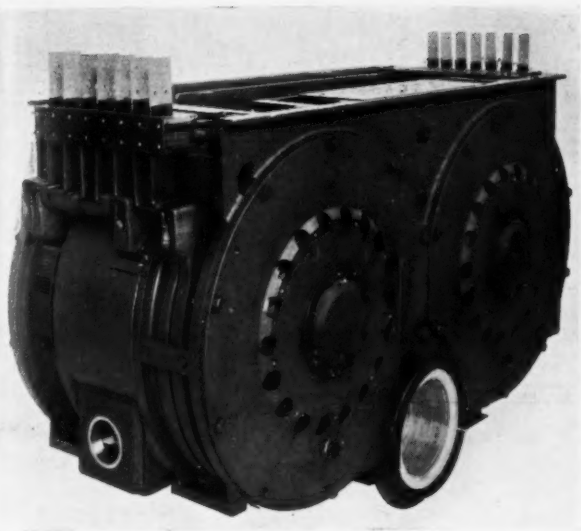
Electric Equipment

The arrangement of the electric equipment is determined to some extent by the type of drive, which fixes the positions of the motors. The nose-suspended motor leaves the whole deck area free for apparatus, but frame-mounted motors project above the deck and restrict the space available. With the Winterthur drive, for example, an arrangement with a central passage is the only one practicable, while the Buchli drive requires a single side passage. In all cases it is desirable to dispose the gear in such a manner that the centre of gravity is maintained over the centre of the track, and on some locomotives the heavier parts of the equipment, such as starting resistances, have been mounted near the roof in order to raise the centre of gravity.

The early improvements in the single-phase motor which were largely responsible for the adoption of individual axle drive on most a.c. lines have already been mentioned. In the period under review progress has continued; the weight per horse-power has been reduced, while commutation has been much improved, with the result that the interval between commutator turnings has been greatly extended. For example, on the P5A locomotives of the Pennsylvania Railroad it is now 250,000 miles. Similar results are reported for the latest units in Switzerland where, in the early days of electric traction, re-turning or grinding was necessary every 6,000-8,000 miles. On one Swiss locomotive a mileage of 400,000 has been accomplished without regrinding, and it is anticipated that it will become possible to allow the motors to run from one general locomotive overhaul to the next without special attention.

The direct-current motor has not undergone so marked a change, and possible improvements in performance and power weight ratio appear, in some cases, to have been foregone in order to secure the advantages of standardisation of an existing design. Such changes as have been made in the design of larger motors have been restricted

Siemens-Schuckertwèrke frequency-changer locomotive for the 20 kV. 50 cycles single-phase Höllental line of the Reichsbahn



Double-armature single-phase motor of 1,250 h.p., Pennsylvania Railroad

largely to detail; alterations in the proportions of the parts, and increases in armature speeds, have not been large.

The two methods of reducing field strength—by shunts and by tappings—are used in about equal proportions when only one or two values of reduction are needed: when several values have to be obtained they are usually used in combination. When shunts are used alone the inductive type is generally employed. The armatures of small and moderate sized direct-current motors are normally wave-wound, but for larger sizes, say, 200 h.p. at 750 volts or 400 h.p. at 1,500 volts per armature, lap windings are sometimes preferred. The main advantage of the lap winding is the better commutation obtained, particularly on heavy overloads or when working with heavy field-shunting. This advantage is secured at the expense of a commutator with twice the number of segments and the provision of equaliser connections.

On both a.c. and d.c. locomotives the totally enclosed motor has disappeared, and almost without exception a separately driven blower is used, either alone or in conjunction with an internal fan. The ventilating ducts in the motors have received attention to avoid pockets where dirt might lodge, and a high air velocity is relied upon to prevent accumulations on smooth surfaces.

Class B insulation is general and the elimination of the small quantities of Class A materials formerly used for mechanical reasons has made considerably higher operating temperatures possible; the temperature-rise of 120° C. as measured by resistance, now recognised by international rules, is conservative and it appears that higher values can be used. It is stated that, with proper design and materials no deterioration occurs at 200° C.

To obtain a sufficient number of economical running speeds every motor combination which can be obtained is used in most cases, each with one or more values of field-weakening. Sometimes, however, the maximum value of field reduction arranged for is used only when the armatures are operating in series and so at reduced voltage. The number of economical running speeds required varies with the service and tends to be somewhat greater for passenger and express units than for freight locomotives. The majority of the locomotives reviewed have from six to nine values, and the highest value is 17.

In a very recent design of locomotive a current-limiter, as distinct from a circuit-breaker, has been fitted. The device operates on rate of rise of current and it inserts a resistance in the circuit which is then opened by line switches. The advantage of the arrangement is its rapid action which prevents the fault current from rising to a high value and so keeps the duty of the line switches in actually opening the circuit within reasonable limits. A similar result has been effected on some locomotives by using a high-speed circuit breaker shunted by a resistance in the place taken by the limiter.

The speed control of single-phase locomotives with commutator motors is always effected by varying the applied voltage by means of tappings on the main step-down transformer. With the exception of one special design, these tappings have always been on the transformer secondary.

The tap-changing mechanism may be of either the sliding contact or the contactor type and is arranged to operate on load by means of preventive chokes. The chokes and contacts are often rated to carry the total current continuously, so that the number of effective running positions is twice the number of tappings. Auxiliary contactors are usually provided to rupture current-carrying circuits during changes, so that the tap-changing mechanism proper is relieved of this duty. In recent years the sliding-contact tap-changer has been losing ground, and contactor-type equipment has been provided in most instances. In addition to, or instead of, the multiplication of running positions given by the preventive chokes a number of railways provide their larger and more powerful locomotives with an auxiliary device to give further intermediate positions. That most commonly employed is a " buck and boost " transformer which multiplies the running positions by 3.

On most alternating-current lines the locomotives have a circuit breaker of adequate capacity to deal with short-circuit currents. The Pennsylvania Railroad provides an exception; the substation feeder breakers are relied upon for the protection of all high-tension equipment on the locomotives. On the occurrence of a fault or overload

310 *b.h.p. English Electric 1,500 volts d.c. motor with wheel and individual axle drive assembly*

TABLE I—Direct-current Main-Line Locomotives

	P.O.-Midi 4 ft. 8½ in. gauge, 1,350 V.				French State, 4 ft. 8½ in. gauge, 1,500 V.		New Zealand Govt., 3 ft. 6 in. gauge, 1,500 V.	Polish State, 4 ft. 8½ in. gauge, 3,000 V.	South African Railways & Harbours, 3 ft. 6 in. gauge, 3,000 V.
Railway serial number	E. 503, &c.	E. 701, &c.	E. 703	E. 704	501, &c.	101, &c.	101, &c.	101, &c.	96, &c.
Makers of electrical parts	C.E.M.	Oerlikon	Als-Thom	Jeumont	C.E.M.	Als-Thom	E.E.C.	Met-Vick	Met-Vick
Makers of mechanical parts	Fives-Lille	Batignolles	Als-Thom	Schneider	Fives-Lille	Als-Thom	Hawthorn-Leslie	Met-Vick & Fabiok	Met-Vick & Hawthorn-Leslie
Type of service	Express	Express	Express	Express	Express	Mixed	Mixed	Mixed	Mixed
Axle classification	2-Do-2	2-Do-2	2-Do-2	2-Do-2	2-Do-2	Bo + Bo	1-Do-2	Bo + Bo	Bo + Bo
Type first in service	1933	1935	1935	1935	1937	1937	1938	1936	1935
Number in service	35	2	1	1	23	35	8 ordered	6	25
Total weight, tons	138·8	134·3	137	134·5	128	79	88	74	65·7
Adhesive weight, tons	78·7	78·7	77·6	79·6	79	79	64	74	65·7
Mechanical parts, tons	89 (approx.)	85·5	81	89·5	79	45·7	61·5	42·7	37·5
Electrical parts, tons	49 (approx.)	47·0	53	44·7	47·5	31·3	26·5	30·5	28·2
Overall length	58 ft. 4 in.	58 ft. 4 in.	58 ft. 4 in.	58 ft. 4 in.	58 ft. 4 in.	42 ft. 3 in.	46 ft. 2 in.	44 ft. 6 in.	43 ft. 8 in.
Overall width	10 ft. 1¼ in.	10 ft. 1¼ in.	10 ft. 1¼ in.	10 ft. 1¼ in.	9 ft. 9½ in.	9 ft. 7 in.	8 ft. 6 in.	9 ft. 6 in.	9 ft. 2 in.
Height (pantograph lowered)	13 ft. 8¼ in.	13 ft. 8¼ in.	13 ft. 8¼ in.	13 ft. 8¼ in.	13 ft. 8 in.	12 ft. 6 in.	11 ft. 6 in.	15 ft. 0 in.	13 ft. 0 in.
Total wheelbase	47 ft. 3 in.	47 ft. 3 in.	47 ft. 3 in.	47 ft. 3 in.	47 ft. 3 in.	29 ft. 5 in.	34 ft. 6 in.	30 ft. 6 in.	30 ft. 11 in.
Rigid wheelbase	19 ft. 10 in.	19 ft. 10 in.	19 ft. 10 in.	19 ft. 10 in.	19 ft. 10½ in.	—	13 ft. 6 in.	—	—
Bogie wheelbase	7 ft. 10½ in.	7 ft. 10½ in.	7 ft. 10½ in.	7 ft. 10½ in.	7 ft. 10½ in.	9 ft. 8 in.	7 ft. 0 in.	9 ft. 3 in.	9 ft. 3 in.
Wheel diameters, driving	69 in.	69 in.	69 in.	69 in.	69 in.	55¼ in.	45 in.	48 in.	48 in.
Wheel diameters, carrying	38 in.	38 in.	38 in.	38 in.	38 in.	—	30¾ in.	—	—
Equalisers between driving axles	All Axles	All Axles	All Axles	All Axles	Fitted	—	Fitted	On each bogie	On each bogie
Equalisers between carrying and driving axles	—	—	—	—	—	—	Truck & driving axles	—	—
Height of centre of gravity	—	63 in.	—	62 in.	—	—	48 in.	54½ in.	49 in.
Traction motors	4, single-armature 6-pole	4, twin-armature 6-pole	2, triple-armature, 6-pole	4, twin-armature, 4-pole	4, single-armature	4, single-armature	4, single-armature, 4-pole	4, single-armature	4, single-armature
Motor ventilation	4 1,350-V. motors and 4 blowers each 4,250 cu. ft./min.	2 1,350-V. sets, each 10,500 cu. ft./min.	6 675-V. motors and 6 blowers, each 3,500 cu. ft. /min.	2 675-V. sets, each 6,600 cu. ft./min.	4 1,500-V. motors. and 4 blowers	2 1,500-V. motors and 4 blowers	2 1,500-V., 16-h.p. motors and 4 blowers each 3,200 cu. ft./min.	2 3,500-V. motors. and 2 blowers	2 3,000-V. motors and 2 blowers, each 3,500 cu. ft./min.
Armature voltage	1,350 V.	675 V.	675 V.	675 V.	1,350 V.	1,350 V.	1,500 V.	1,500 V.	1,500 V.
Total motor rating, h.p. :—									
Continuous	3,265	3,580	3,550	3,550	3,300	1,660 V.	900	1,800	1,000
One hour	3,650	4,110	4,045	4,045	3,700	1,785	1,240	2,200	1,200
Loco. continuous rating :—									
Speed, m.p.h.	44·7	49·5	47·3	48·4	45	39·5	29·3	42·2	23·0
Tractive effort, lb.	27,450	27,100	26,750	27,600	27,000	15,350	11,600	15,440	16,400
Loco. 1-hr. rating :—									
Speed, m.p.h.	42·9	46·7	45·2	46·5	43	38·3	25·5	40·3	21·5
Tractive effort, lb.	31,800	33,000	33,400	32,450	31,500	17,200	18,000	19,850	21,200
Maximum tractive effort, lb.	53,000	53,000	53,000	53,000	44,000	35,000	44,000	—	39,000
Maximum service speed, m.p.h.	81	81	81	81	81	59	55	62	—
Maximum safe speed, m.p.h.	93	93	93·5	93	93	67	60	—	45
System of drive	Buchli and both wheels per axle	Oerlikon, quill and Oldham coupling	Quill and link	Quill and spring cup	Buchli	Nose suspension	Quill and spring cup	Nose suspension	Nose suspension
Type of gear	Twin cushion	Single cushion	Single cushion	Single	Single cushion	Single	Single	Single cushion	Single cushion
Gear ratio, 1 to	2·42	3·55	3·48	3·38	2·31	3·27	3·73	3·13	4·41
Mechanical brakes	Air on locomotives and rolling stock		..	Air on locomotives and rolling stock		..	Air on locomotives and rolling stock		Air on locomotives, vacuum on stock
Wheel brakes and pressure used	Driving 96 per cent., bogie 49 per cent.	Driving 96 per cent., bogie 49 per cent.	Driving 96 per cent., bogie 49 per cent.	Driving 96 per cent., bogie 49 per cent.	—	—	—	—	—
Roller bearings on motors and axles	None	None	None	On motors	None	None	On motors and all axles	None	On motors and axles
Control system main circuits	E.P. contactor	E.P. contactor	E.P. contactor	E.P. contactor	E.P. contactor, camshaft field reduction gear		E.P. contactor	E.P. contactor	E.P. contactors and drum reversers
Armature combinations :—									
Series	4 2 –	8 4 2	6 3 2	8 4 2	4 2 –	4 2 –	4 2	4 2	4 2
Parallel	– 2 4	– 2 4	– 2 3	– 2 4	– 2 4	– 2 4	– 2	– 2	– 2
Total field values	6 6 5	5 5 5	4 4 3	5 5 5	6 6 5	4 4 3	3 3	3 3	2 2
Economical speeds	17	15	11	15	17	11	6	6	4
Values of reduced field	5, min. 26 per cent.	4	3	4	75, 66·5, 48, 39, and 26 per cent.	75, 50, and 40 per cent.	2	2, min. 61½ per cent.	1
Reduction obtained by	Tappings and shunts	Tappings and shunts	Tappings and shunts	Tappings and shunts	Tappings and shunts	Tappings and shunts	Tappings	—	—
Circuit-breakers (in addition to line switches)	High-speed	None	None	None	High-speed	High-speed	High-speed current limiter	None	None
Electric braking	Regenerative	Regenerative	Regenerative	Regenerative	None	None	None	None	Regenerative, 80 V. max., 28-kW. generator on one blower set
Excitation for braking	1,350/100 V. max. 50-kW. M/G set with stabilising motor	1,350/40 V. max. 38-kW. M/G set	1,350/47 V. max. 34·5 kW. M/G set	2 1,350/45 V. max., 22 kW. M/G sets					
Compressors :—									
Number and type	2	2	2 reciprocating	2	2	2	2 reciprocating	2, two-cylinder	1 reciprocating
Motor voltage and rating	1,350 V.	1,350 V.	1,350 V., 12 h.p.	1,350 V. 12 h.p.	1,500 V.	1,500 V.	1,500 V., 8 h.p.	110 V.	100 V.
Capacity, cu. ft./min.	45	45	45	45	56	56	38	70	38
Exhausters :—									
Number and type	—	—	—	—	—	—	—	—	1 rotary
Motor voltage and rating	—	—	—	—	—	—	—	—	100 V.
Capacity, cu. ft./min.	—	—	—	—	—	—	—	—	163
Low-tension supply	72 V. from battery	72 V. from battery	72 V. from battery	72 V. from battery	72 V. from battery	72 V. from battery	120 V., 4-kW. M/G set	2 110 V., 10-kW. generators on blower sets	100 V., 16-kW. generator on one blower set
Battery	72 V., 72 Ah. charged in series with auxiliaries		72 V., 72 Ah. charged in series with auxiliaries		72 V., 85 Ah. charged in series with auxiliaries		120 V., 52 Ah.	110 V.	100 V.
Pantographs :—									
Number and type	—	—	2 single	—	2 double	—	2 double	2 single	2 single
Position under air pressure	—	—	Raised	—	Lowered	—	Raised	Raised	Raised
Working range	—	—	5 ft. 9 in.	—	—	—	6 ft.	7 ft. 6 in.	6 ft. 2 in.
Contact pressure (mean), lb.	—	—	17·5	—	20	—	26	15·5	16
Lightning arresters	None	None	None	Fitted	None	None	Condenser	Condenser	Horn gap
Train heating	At 1,350 V.	At 1,350 V.	At 1,350 V.	At 1,350 V.	At 1,500 V.	At 1,500 V.	Oil-fired boiler	None	None

TABLE II.—Single-phase Main-Line Locomotives

German State, 4 ft. 8½ in. gauge, 15,000 V., 16⅔ cycles

German State, 4 ft. 8½ in. ...

TABLE II.—Single-phase Main-Line Locomotives

	German State, 4 ft. 8½ in. gauge, 15,000 V., 16⅔ cycles		German State, 4 ft. 8½ in. gauge, 20,000 V., 50 cycles				Pennsylvania, 4 ft. 8½ in. gauge, 11,000 V. 25 cycles
Railway serial number	E. 18·01, &c.	E. 44·002, &c.	E. 244·01	E. 244·11	E. 244·21	E. 244·31	Type GG1
Makers of electrical parts	A.E.G.	Siemens Schuckert-Werke	A.E.G.	Brown- Boveri	Siemens Schuckert-Werke	Krupp & Garbe	G.E.C. (U.S.A.) and Westinghouse (U.S.A.)
Makers of mechanical parts	A.E.G.	Henschel	A.E.G.	Krauss- Maffei	Krauss-Maffei	Krupp	P.R.R., G.E.C. & Baldwin
Type of service	Express	Mixed	Mixed	Mixed	Mixed	Mixed	Express
Axle classification	1-Do-1	Bo + Bo	Bo + Bo	Bo + Bo	Bo + Bo	Bo + Bo	2-Co + Co-2
Type first in service	1933	1933	1936	1936	1936	1936	1935
Number in service	33	69	1	1	1	1	58
Total weight, tons	106	76	83·5	83·2	83·5	81·7	205·5
Adhesive weight, tons	79	76	83·5	83·2	83·5	81·7	134
Mechanical parts, tons	62	42·4	43·2	44·2	43·0	42·3	119·5
Electrical parts, tons	44	33·6	40·3	39	40·5	39·4	73·5
Overall length	55 ft. 6 in.	50 ft. 1 in.	47 ft. 0 in.	50 ft. 2 in.	54 ft. 0 in.	49 ft. 6 in.	79 ft. 6 in.
Overall width	10 ft. 4 in.	9 ft. 8½ in.	9 ft. 8 in.	9 ft. 8 in.	9 ft. 8 in.	9 ft. 8 in.	10 ft. 4¼ in.
Height (pantograph lowered)	15 ft. 3 in.	15 ft. 3 in.	15 ft. 3 in.	15 ft. 3 in.	15 ft. 3 in.	15 ft. 3 in.	15 ft. 0 in.
Total wheelbase	42 ft. 0 in.	32 ft. 3 in.	31 ft. 10 in.	32 ft. 2 in.	33 ft. 7 in.	32 ft. 9 in.	69 ft. 0 in.
Rigid wheelbase	Nil	—	—	—	—	—	13 ft. 8 in.
Bogie wheelbase	—	11 ft. 6 in.	11 ft. 2 in.	11 ft. 6 in.	11 ft. 6 in.	10 ft. 10 in.	8 ft. 0 in.
Wheel diameters: driving	63 in.	49¼ in.	49¼ in.	49¼ in.	49¼ in.	49¼ in.	57 in.
Wheel diameters: carrying	39¼ in.	—	—	—	—	—	36 in.
Equalisers between: driving axles	All axles	—	—	—	—	—	Each set of three
Equalisers between: carrying and driving axles	—	—	—	—	—	—	—
Height of centre of gravity	—	—	—	—	—	—	63 in.
Traction motors	4, single-armature, 12-pole	4, single-armature, 8-pole	4, single-armature, d.c. series, 1,700 V. max.	4, single-armature, d.c. series, 800 V. max.	8, single-phase series-commutator, 14-pole, single-armature, 270 V. max.	4, single-phase, 4 three-phase, all single-armature	6, twin-armature, 12-pole
Motor ventilation	4 motors and 4 double blowers	2 motors and 2 blowers	2 motors and 4 blowers	4 motors and 4 blowers	2 motors and 2 blowers	4 motors and 4 blowers	2 55-h.p. motors and 2 blowers, each 25,000 cu. ft./min.
Total motor rating, h.p.:—							
Continuous	3,830	2,470	2,305	2,845	2,435	1 phase 3 phase: 2,630 2,575	4,620
One hour	4,150	2,950	2,680	3,000	2,640	2,840 2,705	(See footnote †.)
Loco. continuous rating:—							
Speed, m.p.h.	75·1	49·6	37	37	37	35·4	90
Tractive effort, lb.	18,650	18,200	22,800	28,100	24,050	—	19,140
Loco. 1-hr. rating:—							
Speed, m.p.h.	73·4	47·2	37	37	37	35·6	—
Tractive effort, lb.	20,700	22,800	26,500	29,600	26,100	—	—
Maximum tractive effort, lb.	46,300	53,000	53,000	53,000	53,000	53,000	72,800
Maximum service speed, m.p.h.	87	56	53	53	53	53	90
Maximum safe speed, m.p.h.	105 attained	—	—	—	—	—	(See footnote ‡.)
System of drive	Quill and cup	Nose suspension	Nose and suspension	Nose and suspension	Nose and suspension	Nose suspension	Quill and cup
Type of gear	Twin skew	Twin skew	Twin skew	Twin skew	Single skew per motor	Twin skew	Single
Gear ratio, 1 to	2·794	4·61	4·5	3·59	5·867	3·8 4·07	3·59
Mechanical brakes	Air on locomotives and rolling stock						
Wheels braked and pressure used	All axles	—	—	—	—	—	All
Roller bearings on motors and axles	On motors	On motors	On motors	On motors	On motors	On motors	On motors and axles
Tap changer	Motor camshaft	Motor camshaft	Grid-controlled rectifier, series-parallel motor connections, and field weakening	Rectifier with h.t. tap-changer giving 28 voltages	Manual camshaft	(See footnote *.)	E.P. contactor
Control gear	E.P.	E.P.	—	—	E.P. contactor	—	E.P.
Transformer main voltages	15	15	7	None	14	1	11
Intermediate values	Reversible booster	Reversible booster		28	Reversible booster	By rotor resistance	Buck and boost transformer
Total running points	15	15	2,160	1,980	14	3	66 (including 12 shunting)
Transformer:—			7·3	8·8	1,720	1,900	4,800
Rating (excluding heating), kVA.	2,920	1,450	Separate	Separate	4·8	5	15·3
Weight, tons	7·9	7·1	Forced	Forced	Separate	Separate	—
Transformer cooler	Tubes on tank	2 separate coolers	Forced	Forced	Forced	Forced	Forced
Air circulation	1 motor, 2 blowers	Coolers in series with motors	Air-blast	Oil	Air-blast	Air-blast	Forced
Oil circulation	Separate motor and pump	Separate motor and pump	Rheostatic	Rheostatic	Rheostatic	Regenerative	None
Main circuit-breaker	Air-blast	Air-blast	Rectifier operating at 10 per cent. maximum voltage	Self excitation	2 motors used as generators	None	None
Electric braking	None	None	1, two-stage recip.	1, two-stage recip.	1, two-stage recip.	1, two-stage recip.	—
Excitation for braking	—	—	59	59	59	59	1, recip. 35-h.p. motor
Compressors:—			—	—	—	—	150
Number and type	1, two-stage recip.	1, two-stage recip.	—	—	—	—	—
Capacity cu. ft. min.	53	59	—	—	—	—	—
Exhausters:			200 V. 3-phase from converter; 24 V. (d.c.)	200 V. (d.c.) from rectifier; 24 V. from battery	220 V. (a.c.); 24 V. (d.c.) from battery	220 V. 3-phase; 24 V. (d.c.)	Single-phase and 32 V. (d.c.)
Number and type	—	—	24 V.	24 V.	24 V. charged through rectifier	24 V. charged from converter	32 V. 300 Ah.
Capacity, cu. ft. min.	—	—					
Auxiliary supplies	200 V. (a.c.) and 24 V. (d.c.) from battery	200 V. (a.c.) and 24 V. (d.c.) from battery					
Auxiliary battery	24 V. charged through rectifier	24 V. charged through rectifier					
Pantographs, No. and type	2 single						2 double
Position under air pressure	Raised						Lowered
Working range	5 ft.						10 ft. 3 in.
Contact pressure (mean), lb.	11						30
Lightning arresters	—						One
Train heating	From main transformer at 800 V. and 1,000 V. 250 kW.; also 600 V. on E.04 and E.05		From main transformer at 800 V. and 1,000 V. 320 kW. (400 kW. on E. 244·01)				Oil-fired boiler, weight 7·1 tons, 4,500 lb. steam per hr. at 200 lb./sq. in.

* The single-phase motors have intermediate rotors excited with direct current, enabling them to act as phase convertors.

† Short-time rating 9,500 h.p. at 49 m.p.h

‡ Mechanical parts and riding safe at 100 m.p.h.; motors not suitable for continuous operation above 90 m.p.h.

on a locomotive all the main low-tension contactors open, and if the fault current persists the pantograph is earthed, thus opening the substation circuit breaker. Subsequently the pantograph is automatically lowered and locked down.

When the contact line voltage does not exceed 1,500 it is usual for all auxiliary motors to operate at line voltage, but on higher-voltage systems compressor, exhauster and, perhaps, blower motors have generally been fed from a fixed-voltage generator driven by a motor operating at line voltage. Recently, however, 3,000-volt locomotives have been built in which all the motors operate at line voltage. In many cases the design of 3,000-volt auxiliary motors has been simplified by using two commutators or two separate motors in series, but single-commutator types are in use.

The question of whether a single or a double contact pan should be employed is interesting. On direct-current locomotives the double pan was used almost exclusively, but the single pan has been adopted for the standard series of locomotives on the Italian State Railways, for the new locomotives of the South African Railways, and for the Polish State Railways. These locomotives operate at 3,000 volts and the single pan has found only one extensive application on 1,500-volt systems, that of the Paris—Orleans lines, where the majority of the more recent units are so fitted. The change to a single pan in South Africa seems significant, as the new units were ordered to the same general specification as the original 95 units with double pans.

The advantages of electric braking on long gradients lie more in the reduction in wear of the mechanical parts of the locomotives and rolling stock than in the value of energy returned to the supply system. In the system normally adopted for d.c. traction the traction motor fields are excited from a motor-generator set fed from the line; to maintain stability under sudden changes of line voltage and to prevent overloads with abrupt increases in gradient, the current returned to the line is passed through a resistance which is common to the main circuit and to the excitation circuit.

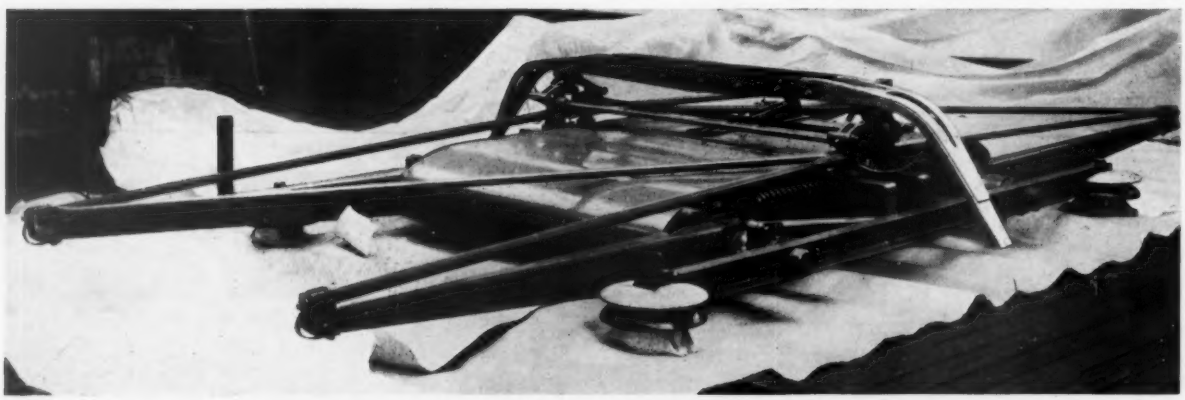
Rheostatic braking possesses the advantage that it is entirely independent of the supply system, but limitatons of space and weight make it difficult to carry a resistance large enough to dissipate more than a relatively small proportion of the total possible output from the motors. On direct current lines it has, in consequence, been used in only a few instances where the traffic is light and the supply system would have had difficulty in absorbing regenerated energy. Rheostatic braking has been adopted on single phase lines more frequently than on direct current lines. The current generated may be either alternating (in which case the excitation is taken from the line) or direct (in which case the motors can be self exciting).

The subject of industrial frequency single phase lines has always been one of considerable interest in view of the large savings in substation plant and the improved efficiency which can be obtained by this means on single phase lines which take their supply from an industrial generating and distributing system. On the Hungarian Railways a single type of locomotive is used for all purposes. It has a single induction-type motor fed from a specially developed phase convertor.

The electrical equipments of the four Höllental locomotives of the Reichsbahn are the products of four different firms; two of them use mercury rectifiers to supply four standard series-wound motors, and the other two use motors designed to operate on a 50-cycle supply. On the rectifier locomotives, starting and speed control are effected by varying the rectifier output voltage, which can be reduced to the necessary low value. On one unit this is accomplished by a tap-changing switch on the transformer high-tension windings, and on the other unit by grid control supplemented by series-parallel and field-weakening switching in the motor circuits. The grid control is arranged to vary the voltage, partly by retarding ignition and partly by selecting, according to the controller position, one of two sets of anodes supplied from the transformer at different voltages.

The third locomotive is equipped with two 50-cycle series-wound commutating motors per axle, eight in all, and the control gear is similar to that standardised on $16\frac{2}{3}$-cycle lines of the German Railways. The motors, which operate at a low voltage per commutator segment, are connected permanently in pairs, and it may be noted that they each have 14 brush-holders each carrying four brushes.

The fourth locomotive is fitted with a phase convertor and a three phase induction motor per axle, again eight machines in all. The phase convertors have wound rotors and stators between which there is a free intermediate rotor excited with direct current. This provides the rotating field necessary for phase conversion. During starting and when running at reduced speed the phase convertors act as motors. There are three machine arrangements; in the first the convertors and motors are in cascade, thus comprising eight driving motors, in the second the convertors act alone as motors, and in the third the motors are fed from the stators of the convertors, which then develop no driving torque. Intermediate speeds are obtained by electrolytic rotor resistances, and regenerative braking takes place automatically in all the arrangements if the speed rises above synchronism.



Modern light-weight pantograph of single-pan type, Netherlands Railways

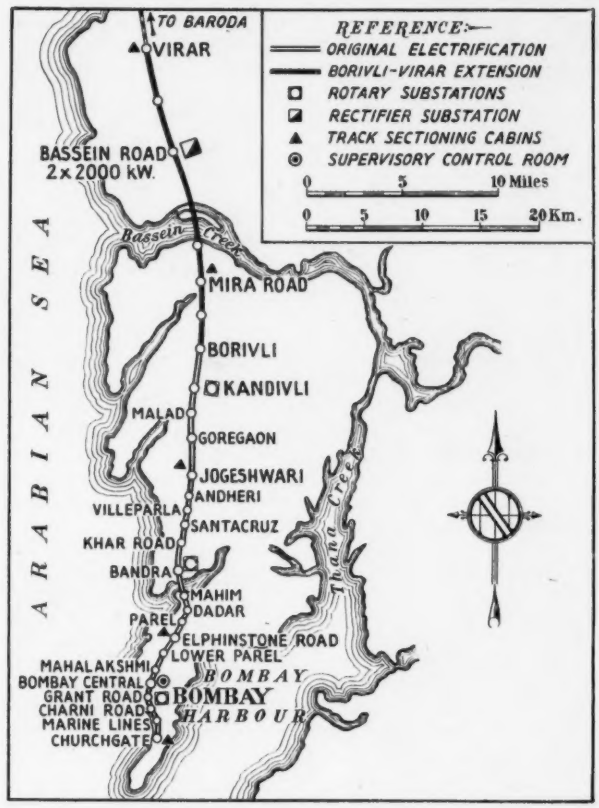
GLASS-BULB RECTIFIER SUBSTATION IN INDIA

330 kW. bulbs and grid-control incorporated in 4,000 kW. installation on the B.B. & C.I.R.

THE electrified broad-gauge lines of the Bombay, Baroda & Central India Railway cater for the Bombay suburban traffic, and are shown in the attached sketch map. The original electrification was carried out in 1928 and extended as far as Borivli, 20 miles north of Bombay on the main line. It is fed by three rotary converter substations adjoining the lines and situated at Grant Road, Bandra and Kandivli stations respectively; these three substations are remotely-controlled from the power supervisory control room in the Divisional Engineer's office at Bombay Central station. The 1936 extension carried the electrification on from Borivli to Virar, adding a further 16 miles of electrified track. This section is fed by a substation at Bassein Road, which is equipped with Hewittic glass-bulb rectifiers, and the whole of the substation equipment was supplied to the specification of Messrs. Merz & McLellan, Consulting Engineers to the B.B. & C.I.R. The overhead equipment of the Borivli—Virar extension is sectionalised through remotely-controlled circuit breakers, housed in cabins at Churchgate, Elphinstone Road, Jogeshwari, Mira Road, and Virar.

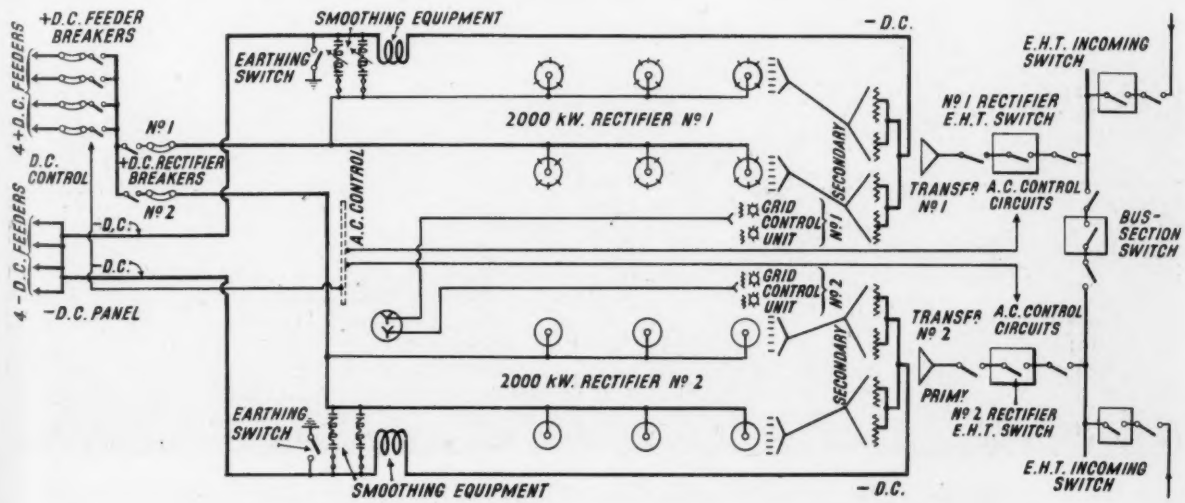
The Bassein Road rectifier substation feeds a 16-mile section (approximately 8 miles on each side), and operates in conjunction with the over-compounded rotary converters supplying the original electrified section. This conjoint working necessitated over-compounding of the rectifier plant to compensate for heavy traction load fluctuations and at the same time a compensation for a heavy transmission line drop.

Electrical energy at three-phase 50 cycles 110 kV. is transmitted from the power stations to a transformer station by means of overhead lines, and from this transformer station is led to the railway substations at a tension of 22 kV. by means of overhead lines and underground cables. The supply is converted at the Bassein Road and other substations into direct current at 1,500 volts to feed the overhead contact wires, and the Bassein Road plant is arranged to over-compound from 1,530 volts at no-load



Above: Map of suburban electrified system of the Bombay, Baroda & Central India Railway's broad-gauge lines out of Bombay

Below: Schematic diagram of main circuits, Bassein Road glass-bulb grid-controlled rectifier substation



to 1,550-volts at full load, the range and setting being adjustable. The rectifier plant was also required to compensate automatically and simultaneously for a transmission line drop up to 10 per cent. The substation capacity at Bassein Road is 4,000 kW. arranged in two 2,000 kW. banks with overload capacities of 25 per cent. for two hours; 50 per cent. for 15 min.; 200 per cent. for five min.; and 300 per cent. momentarily.

Rectifiers and Connections

The rectifiers are arranged in two 12-phase six-bulb banks, and each 2,000 kW. rectifier bank accordingly comprises six rectifier bulb units supplied through a 3/12-phase static transformer. Each rectifier bulb unit is assembled in a cubicle containing a bulb automatic starting and maintaining circuit, and ventilating fan, fuses and equalising coils in the anode circuits, the latter being oil-immersed. Each group of three bulbs works in parallel from each of the two six-phase groups forming the main transformer 12-phase secondary, and is connected thereto by means of busbars running along the top of the rectifier cubicles. The transformer is of the oil-immersed naturally-cooled core type, connected delta on the primary side and zig-zag 12-phase on the secondary side, and has interphase transformers connected between the neutral points. Surge arrestors are connected to the secondary terminals of the main transformers.

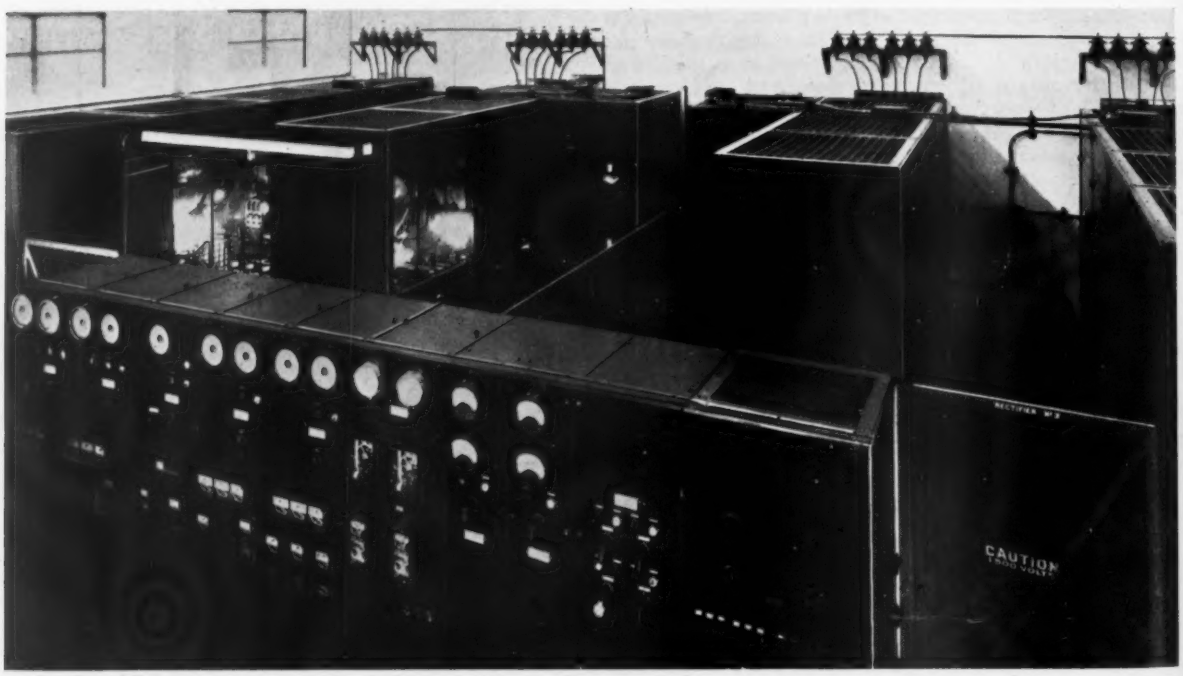
The supply to the auxiliary circuits in the rectifier units is also obtained from the main transformer, which includes a fan choke control device by means of which the supply voltage to the fan circuit varies according to the load output from the equipment, so varying the speed of the cooling fan motors. With each rectifier bank is also included a smoothing equipment which comprises a reactance oil in the negative feed from the transformer neutral and two filter circuits for 600 cycles and 1,200 cycles respectively; all are housed in a cubicle similar to the rectifier unit cubicles. The following efficiency figures were obtained on test, and they cover the whole of the rectifier plant, including the transformer and auxiliary gear at various loads:

5/4 load	95·0 per cent.
4/4 ,,	96·5 ,, ,,
3/4 ,,	96·5 ,, ,,
2/4 ,,	96·4 ,, ,,
1/4 ,,	95·2 ,, ,,
No load losses	12 kW.

The e.h.t. switchgear controlling the supply into the substation is of the Reyrolle metalclad compound-filled type comprising two incoming feed units, a bus coupler switch and two rectifier control switches. The Metro-Vick d.c. switchgear comprises two rectifier output breakers and four outgoing feeder breakers, all of the high-speed type assembled in withdrawable trucks. All these are controlled from the main substation control board. The diagrammatic arrangement of the plant is shown in an accompanying illustration. The e.h.t. switchgear and transformers are enclosed in separate sections of the building, with the rectifier plant control board and d.c. switchgear in a third section: the layout of the plant follows logically the sequence of electrical functions.

The overcompounding and transmission line drop compensation referred to above are carried out by means of grid control. For this purpose all the main rectifier bulbs are fitted with control grids, one per anode, and the grid control circuit is governed by means of a paralleling control device together with a voltage and load compensating device.

In a rectifier bulb, while a grid is negative to the cathode the corresponding main anode cannot start even though it has a potential positive to cathode. When the grid becomes positive to the cathode the main anode can start up, and once it has started up the grid has no further control of the arc and the anode will continue to carry current until it becomes negative to the cathode. Therefore, by retarding the point in the cycle at which the grid becomes positive to the cathode, the anode is caused to strike up at a later point than normal, which results in



Interior of Bassein Road substation showing glass-bulb rectifiers and control panels

1,500 *volts d.c. suburban train on the Bombay Baroda & Central India Railway*

a decrease of the average value of the d.c. volts over a cycle. It will thus be seen that by altering the phase of the grid supply by means of a small induction regulator, the main d.c. volts may be altered down to zero from the value they would have working as a normal rectifier.

The supply to the grid must consist of instantaneous positive impulses to each grid at the point in the cycle at which it is desired to start up the main anode. This impulse control is necessary in order to ensure correct parallel operation of a bank of large rectifier bulbs and also to give the correct load-sharing on the multi-phase secondary output. These impulses are obtained by means of a rectifier impulse generator which is in fact a minute replica of the main equipment, and like it, static throughout.

A small induction regulator controls the supply to this grid circuit, and the variation of phase-angle displacement required between the main anodes and the control grids to suit different circumstances is obtained by altering the position of the rotor of this regulator relative to its stator; this is done automatically and instantly by a quick-speed regulator device direct-coupled to the induction regulator. This regulator device is sensitive in operation, and responds to voltage variations of approximately $\frac{1}{2}$ per cent.; it is rapid, completing a correction for load output or input supply fluctuations within $\frac{1}{10}$ of a second; and it is readily adjustable within wide limits by means of calibrating rheostats for mean setting or varying amounts of compounding. The equipment described has now been in service for over 12 months and service conditions have confirmed the satisfactory operation and completeness of this form of control.

AUSTRIAN ELECTRIFICATION.—In connection with the electrification of the Vienna-Salzburg line, a new hydro-electric plant is being built alongside the existing equipment at Stubach, not at Spullersee, as given in our issue of March 4.

POSSIBLE NORWEGIAN EXTENSIONS.—The Norwegian Premier, M. Nygaardsvold, stated recently that new government expenditure would include a sum equivalent to £4,000,000 to electrify sections of the Norwegian State Railways.

PENNSYLVANIA LOCOMOTIVES.—Eleven new 2-Co+Co-2 single-phase electric locomotives of the GG1 class have been built by the Pennsylvania Railroad at its Altoona shops for operation over the newly-electrified Paoli-Harrisburg division. The total number of electric locomotives at work on the Pennsylvania is 202, of which 69 are of the GG1 type.

BELGIAN-DUTCH ELECTRIFICATION.—In the course of some discussions on outstanding railway questions affecting Holland and Belgium, representatives of the two countries in conference at The Hague on March 29 dealt with the improvement of communications between Antwerp, Brussels and the Netherlands railway system, especially with Rotterdam and Amsterdam. Electrification of the two sections, one from Antwerp to the Dutch-Belgian frontier at Esschen, the other thence to Dordrecht was proposed and it is understood that both countries are now to look closely into its possibilities. It is understood, further, that proposals have been approved for the electrification of the Brussels-Charleroi line of the Belgian National Railways.

GERMAN ELECTRIFICATION.—Dr. Wechmann, Chief Engineer for Electric Traction of the Reichsbahn, on April 27 read a paper on long-distance electrification on the German State Railway before the Institution of Locomotive Engineers. After describing briefly the three main-line electrified systems (Silesia, Central Germany, and Bavaria-Wurttemberg), Dr. Wechmann mentioned why there was comparatively little electrification in Baden despite the abundance of water power, and considered at some length the pros and cons of single phase and d.c. types of current supply as they affected and were affected by conditions in Central Europe. Tractive effort and horsepower curves were given for the new E.19 electric locomotive with a 1-Do-1 wheel arrangement, and which is suitable for a top speed of 170 km.p.h. (106 m.p.h.). The output under favourable rail conditions reaches 6,000 h.p. at 93 m.p.h., and about 6,200 h.p. at higher speeds.

XUM

Stainless Steel Trains in Italy

Pneumatically-operated doors for Milan suburban trains

Several stainless steel motor-coaches built on the Budd Shotweld system have been supplied by the S.A. Piaggio, of Genoa, to the North Milan Railway, for service on the electrified lines to Saronno and Como. These coaches tare 21½ tons and have 32 first class and 56 third class seats. The length over headstocks is 71 ft. and the bogies are pitched at 52 ft. 8 in. centres; the wheels are 35½ in. in diameter and the top speed is 62 m.p.h.

LETTER TO THE EDITOR

Modern Suburban Trains

Acton Works, April 7

TO THE EDITOR, *Electric Railway Traction Supplement*

SIR,—I have read with interest your note on "Modern Suburban Trains" in the number of April 1. I am surprised to see electric train motive power listed on a basis of one-hour rating when today it is generally realised that the continuous rating of the equipment is the true basis of comparison. The one hour rating may be of moment as indicating (and then not fully) the possible acceleration, since the accelerating current may be taken as a factor of the one-hour rating current, but if the acceleration is to be applied frequently as in a stopping service, the accelerating current has to be merged into the calculation of the root mean square of the current for the service, and this has to be covered by the continuous rating of the motor. It is for this reason, of course, that the ventilated motor has displaced the totally enclosed motor in modern equipments. In a non-stopping service the acceleration is commonly immaterial and, again, the continuous rating is the important basis. The high figure of 10 h.p. per ton on the Southern Railway would seem to arise from the need to obtain an adequate continuous rating from totally enclosed motors.

Further, Sir, you state that there is little to choose between vestibule and compartment stock carrying capacity. While no one admires crowding of trains, it is, of course, an economic necessity at rush hours, and actual counts have shown greater loadings in vestibule cars of similar size than in the Southern Railway cars you quote with six standing per compartment.

Beyond this question, however, is the more important one of station stop on which so largely depends the service in trains per hour. Station stops with compartment stock are by many observations much longer under like conditions than with vestibule stock having a proper number of sliding doors. It can readily be shown that it would be impossible to operate stopping services of 40 trains per hour with compartment stock, unless the acceleration and braking rates are made inordinately high and/or the maximum speed reduced very considerably. In the case of really intense (and actual) services, demanding the maximum utilisation of line, the vestibule type car is the only alternative to doubling the track either wholly or at the stations.

In conclusion may I suggest that the only true comparison between rolling stocks is one made on a basis of weight (or horsepower) per square foot of available passenger space, ignoring any question of seating. How the space is utilised, *i.e.*, by seats or standing space, with austerity, comfort or luxury, is a matter of circumstance or policy and not one affecting engineering comparison.

Yours truly,

W. S. GRAFF-BAKER,

Chief Mechanical Engineer, L.P.T.B.